In This Issue: Concentration at Inspiration—II

SEP 11 1916
UNIV. OF MICH.

Engineering and Mining Journal

Volume 102, No. 11
Issued Every Saturday
Hill Publishing Company

NEW YORK, SEPTEMBER 9, 1916

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

a complete power plant for the mine

to drive hoists, generators, line shafting, pumps, crushers, compressors—enormous power from cheap fuel oils

Ask for Bulletin S130-16

WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway, New York — Snow Works, Buffalo, N. Y.

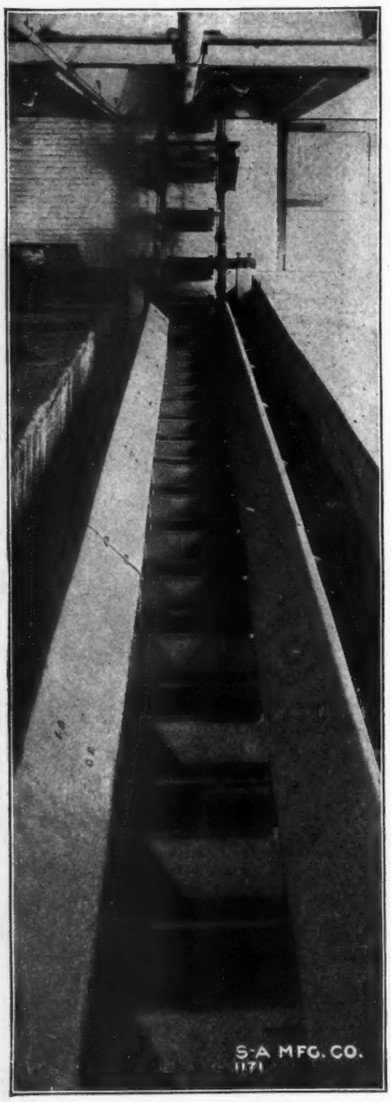
BRANCH OFFICES

Atlanta Boston Buffalo Chicago Cincinnati Cleveland Denver Detroit El Paso Houston Kansas City Los Angeles New Orleans Philadelphia Pittsburgh St. Paul St. Louis Salt Lake City San Francisco Seattle

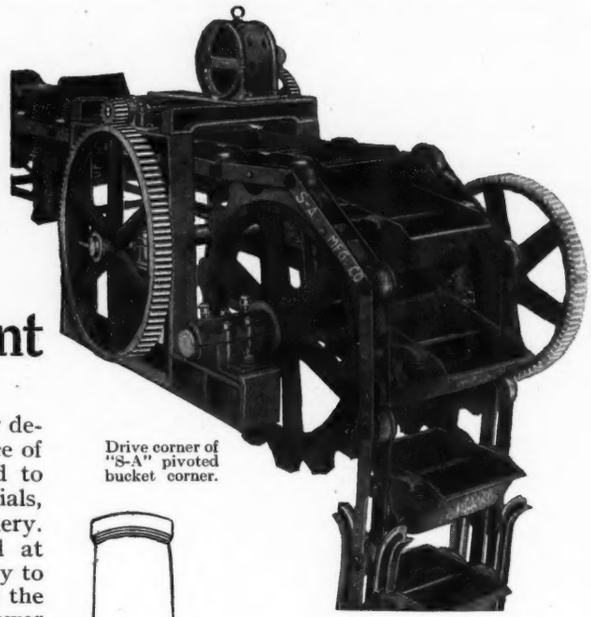
S-209

The S-A Page

Published Weekly in the Interests of S-A Conveying Engineering



Handling Coal in Your Power Plant



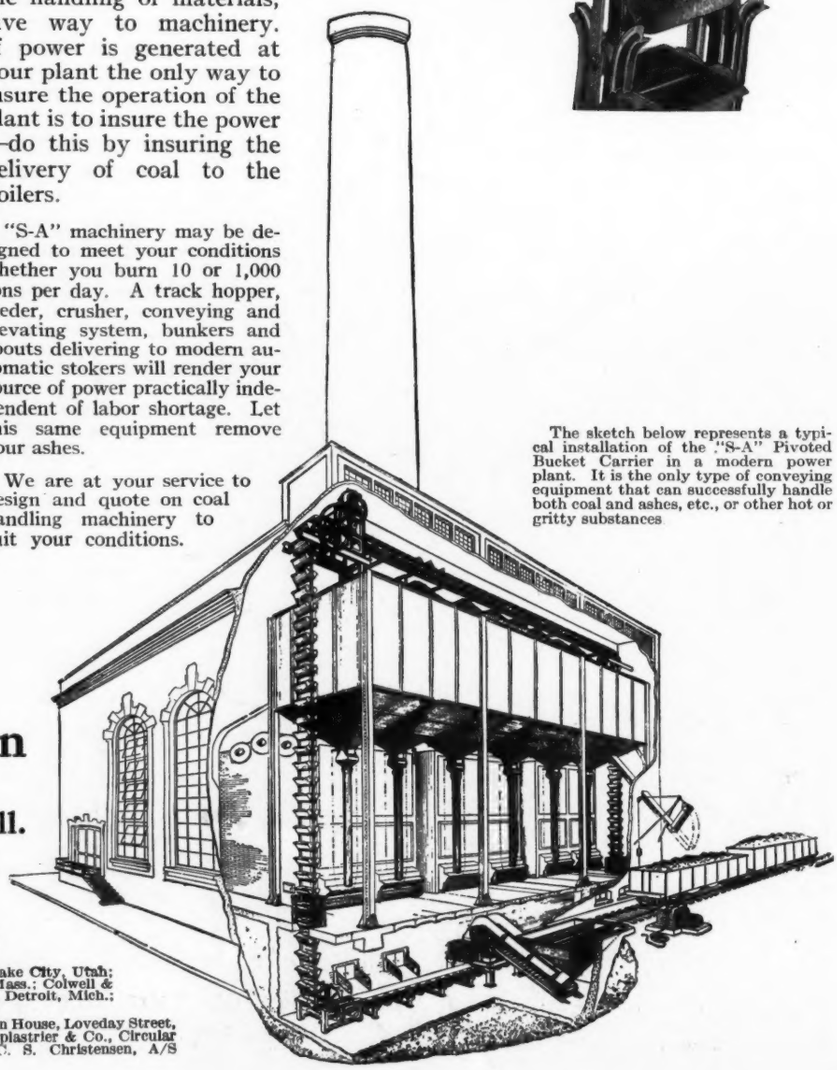
Drive corner of "S-A" pivoted bucket corner.

The scarcity of labor demands that every ounce of human energy devoted to the handling of materials, give way to machinery. If power is generated at your plant the only way to insure the operation of the plant is to insure the power—do this by insuring the delivery of coal to the boilers.

"S-A" machinery may be designed to meet your conditions whether you burn 10 or 1,000 tons per day. A track hopper, feeder, crusher, conveying and elevating system, bunkers and spouts delivering to modern automatic stokers will render your source of power practically independent of labor shortage. Let this same equipment remove your ashes.

We are at your service to design and quote on coal handling machinery to suit your conditions.

The sketch below represents a typical installation of the "S-A" Pivoted Bucket Carrier in a modern power plant. It is the only type of conveying equipment that can successfully handle both coal and ashes, etc., or other hot or gritty substances.



"S-A" Catalog No. 22 covers this line of our manufacture very completely. Sent on request.

Stephens-Adamson Mfg. Co.

Aurora - - - Ill.

Cable Address, Saco.

Conveying Screening **Transmission Machinery**

BRANCHES:

50 Church Street, New York, N. Y.; First National Bank Bldg., Chicago, Ill.; H. W. Oliver Bldg., Pittsburgh, Pa.; Federal Reserve Bank Bldg., St. Louis, Mo.; First National Bank Bldg., Huntington, W. Va.; 503 Dooly Block, Salt Lake City, Utah; J. W. Gates, District Manager. 79 Milk St., Boston, Mass.; Colwell & McMullin, District Managers. 824 Dime Bank Bldg., Detroit, Mich.; 310 Stair Bldg., Toronto, Ont.; E. J. Banfield, Agent.

So. African Agent, J. MacG. Love & Co., Ltd., 1 and 3 London House, Loveday Street, Johannesburg, So. Africa. Australian Agent, Arthur Leplastrier & Co., Circular Quay East, Sydney, Australia. Scandinavian Agent, C. S. Christensen, A/S Post Box 85, Kristiania, Norway.

Engineering and Mining Journal

VOLUME 102 SEPTEMBER 9, 1816 NUMBER 11

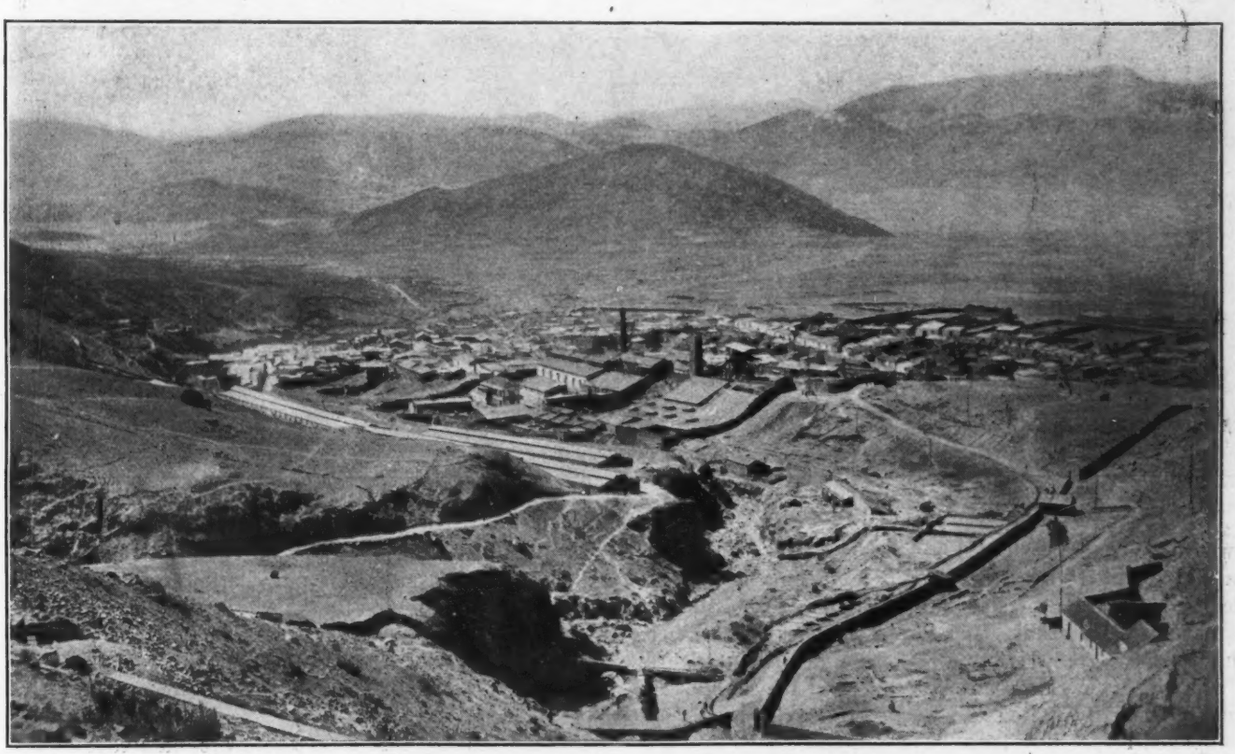
The Patiño Tin Mines, Bolivia

By Benjamin L. Miller* and
Joseph T. Singewald, Jr.†

SYNOPSIS—A description of the tin mines owned by Patiño, who was formerly a day laborer, but whose conviction of the possibility of mining tin ore in Bolivia raised him to the position of the wealthiest man in Bolivia and placed tin mining at the head of the Bolivian mining industry.

The history of mining is replete with stories of spectacular discoveries and suddenly enriched miners. In almost every country one finds wealthy families whose fortunes can be traced back to some remarkable mines. In some instances these fortunes have been acquired through good luck entirely, but in most cases some men possessed greater foresight than others and were willing to stake all they possessed on their beliefs. To the latter class belongs Simon I Patiño, the Tin King of Bolivia. From an ordinary day laborer in the mines, in a few years he became a multimillionaire, the wealthiest man in Bolivia; and his entire fortune is due to his conviction that tin ore could be profitably mined in Bolivia.

The world had come to look upon tin as a product in which Cornwall, the Malay Peninsula and adjoining islands and Australia were almost the sole sources of supply, and thus the tin ore encountered in Bolivian silver mines was ignored and discarded as waste. Patiño, however, realized the possibilities of these Bolivian ores.



THE TOWN OF UNCIA, BOLIVIA

He secured options on numerous mines and old dumps rich in cassiterite ore, and through persistance was able to obtain the necessary capital to prove his contention. To him Bolivia owes much, as tin mining now occupies first place in the mining industry of the country, followed by copper, bismuth and silver; 36,324 tons of tin barrilla carrying from 60% to 65% Sn was exported during 1915. One of the Patiño mines, the Salvadora

*Professor of geology, Lehigh University, South Bethlehem, Penn.

†Associate in economic geology, Johns Hopkins University, Baltimore, Md.

at Uncia, contributed more than 25% of the total, according to figures at hand, and continues to hold the record as Bolivia's premier tin mine.

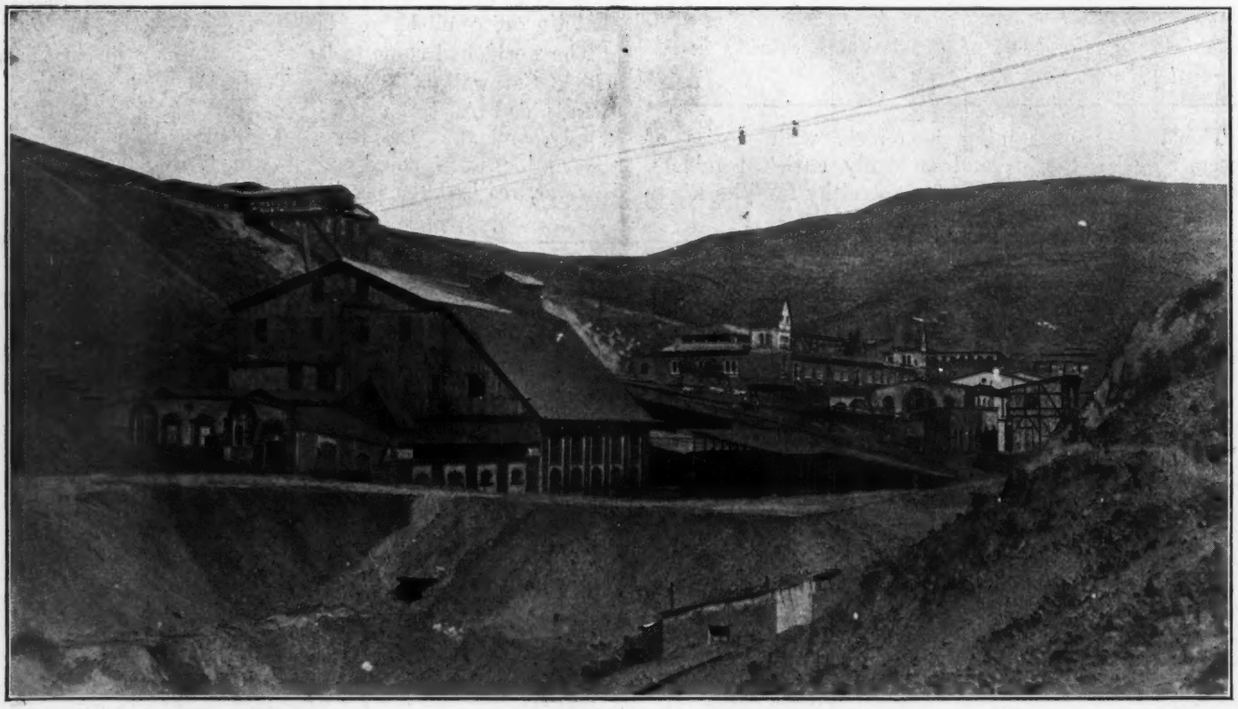
Señor Patiño has not only enriched himself through his profits in tin mining, but by his support of various enterprises has done so much for the development of his country that he well deserves the gratitude that he receives from the Bolivians. It must be admitted, however, that several of his industrial and agricultural ventures have not been successful. He has spent most of his time in Europe in recent years, leaving his mines in charge of Maximo Nava, who unquestionably is one of the ablest mining men that Bolivia has produced. Patiño's principal mines are located at Uncia and Huanuni.

La Salvadora and Llallagua, the two greatest tin mines of Bolivia, are located in the same mountain 42 mi. southeast of Machacamarca, a station on the Antofagasta-LaPaz R.R., a short distance south of Oruro. Patiño owns La Salvadora, while Llallagua is owned by Chilean capital operated under the name of Compania Estañifera de Llallagua. Patiño had built a railroad from Machacamarca to Kilometer 40 (Punta de Rieles) and had the roadbed graded several kilometers farther toward Uncia when the European War depressed the tin market and temporarily halted the work. It will no doubt be completed before very long. The railroad passes through Huanuni, the other important tin-mining district controlled by Patiño.

At the terminus of the railroad, passengers are taken by stage to Uncia, a distance of 18 mi. over rough roads through a very hilly country. It requires 5 hr. for the trip and costs 12 bolivianos a passenger ($3.60). Supplies for the town of Uncia which has a population of about 8,000 people, are mainly brought from the railroad by llamas; the country itself is arid and treeless and produces very little. Fortunately, the scant, coarse grass is sufficient for the llamas and alpacas, the two animals on which the country is dependent for fuel, wool, meat and transportation.

The hill from which almost one-half of Bolivia's annual production is obtained is composed of a central mass of porphyritic rhyolite which has been intruded through a thick series of slates and shaly sandstones in most places decidedly carbonaceous and dark in color, but near the town of Uncia there is considerable red shale. No fossils were found in these sedimentary rocks, but they belong to the great series of shales so prominently developed in the Eastern Cordillera and generally believed to be of Devonian age. In view of our discovery of widespread Tertiary shales in the vicinity of Potosi it seems probable that the Uncia shales may also be found to be of much more recent age, and it is hoped that fossils may be found. The shales outcrop on the lower flanks of the mountain.

Within the rhyolite there are occasional small dikes of basic rocks, which in places are in close association with the ore veins and suggest some relationship with them. However, ore veins are found where the dikes are not present, and vice versa. A series of faults or a fault zone about 20 m. in width displaces the veins of both mines. The only other evidence of movement is gouge material along the veins.



THE PATIÑO MILL, UNCIA

Throughout the mountain there are numerous veins, the most important of which have received names. The main tunnel of the Salvadora mine, Socavon Patiño, cuts in order the following veins: Victoria, Animas, Bismarck, San Miguel, Salvadora, Demasias, Inca and One A. In the Llallagua about 15 veins have been found, of which the Reggis, Blanca and San Jose are the most important. In general the veins have approximately parallel strikes, about N. 30° E., with steep dips to the Northwest or Southeast. Several of the southeasterly dipping veins of the Salvadora mine pass into the ground owned by

the Llallagua company, while some of the northwesterly dipping veins of the latter company enter the ground owned by Patiño. If the apex law were in force in Bolivia, there would, no doubt, be endless litigation between the two companies. Even without it there was much trouble between them for several years, and both companies made liberal purchases of firearms for defense. But their difficulties have all been adjusted now, and they are coöperating in the construction of a tunnel that will drain both properties.

The veins are extremely variable in width. Within a few yards a vein may be found to widen from a few inches to several feet and perhaps entirely disappear a few yards beyond. Naturally, stoping is confined to the wider portions of the veins only.

The veins are in part true fissure fillings and in part the cemented fragments of breccia along fracture zones. The principal ore mineral is cassiterite of very dark color, practically black. In the true veins it is fine-grained and compact, but in the breccia there are numerous open cavities, or vugs, lined with cassiterite crystals. In places the cassiterite crystals in the vugs have been formed on quartz crystals previously formed. Some of the cassiterite ore crumbles very readily, almost making a powder when broken.

Considerable bismuthinite occurs in the ore, but as yet no attention has been given it. While the bismuth content is not as great as one may think from a casual examination of the ore, due to the thin-bladed crystals of the bismuthinite determining the place where the ore breaks and consequently showing prominently on the surfaces of the ore fragments, yet there is little doubt that some pieces of rich bismuth ore could be sorted out by hand with profit.

Wolframite and scheelite are present, but until recently no efforts were made to separate them from the cassiterite. In March, 1916, the first shipment of tungsten concentrates was made. It assayed 56% tungstic acid, and the company was at that time obtaining 500 lb. a day. A little native copper and some chalcopyrite have been found, but not in economic quantities.

Pyrite is almost the sole gangue mineral, with small amounts of marcasite, arsenopyrite, pyrrhotite, quartz, siderite and aragonite. Most of the quartz is in the vugs. In the upper part of the mountain where the veins have now been almost worked out there was considerable oxidized ore, *pacos*, of porous character and stained with limonite. Some pockets of unusually rich tin ore were encountered in these early workings near the top of the hill, but in general the veins in the oxidized zone carry just about the same values as in the sulphide portion. In weight the *pacos* ores are richer, due to the removal of most of the gangue materials by oxidation and solution.

Mining by Tunnels and Drifts

The first mining was done by open-cut in some of the veins outcropping near the summit of the mountain. Later a tunnel was run into the mountain at an elevation of 14,446 ft. This tunnel is still in use; during 1915 about 150 tons of ore a month came from it. The main workings are now carried on through the Socavon Patiño, which cuts the veins at an elevation of 13,200 ft. This tunnel is 7,312 ft. long and cuts the different veins. From it drifts have been run following the veins and stopes driven where the veins are sufficiently wide to pay. A new tunnel has been started 90 ft. lower than the Patiño but, on account of the water, work has been stopped until the completion of the joint tunnel, previously mentioned. Above the level of the Salvadora tunnel the ore was mainly oxidized, but little *pacos* has been obtained from the workings of the Socavon Patiño.

Aërial trams connect the Salvadora and Patiño tunnels with the mill. At the mouth of the tunnels Cholo women sort out some of the richest ore, called *guia*, which is shipped without further concentration. The Salvadora mine produces monthly about 50 tons of *guia*, containing from 6% to 65% Sn.

Professor Copeland and Mr. Hollister last year described the milling of the ores at Llallagua very fully in the *Journal*[1], so it is unnecessary to describe the methods employed at the Uncia mill in detail as the two mills are similar. After passing over trommels the coarse ore goes to ball mills equipped with 19-lb. steel balls. The resulting product is sized by trommels into three grades. The oversize, greater than 5 mm., goes to two jigs, the material from 2 mm. to 5 mm. to two other jigs, and the finest to a hydraulic classifier. The further treatment is by regrinding the coarser materials from the jigs, further treatment on Ferraris and Humboldt tables and finally in buddles. In the new mill, now in process of construction, the treatment will be somewhat modified. The old mill produced about 900 tons of tin barrilla a month, while the new mill is expected to produce from 1,200 to 1,500 tons monthly.

The barrilla is put in bags and transported to the terminus of the railroad by carts or by llamas. Roughly, about two-thirds is carried by llamas at a cost of $10 a ton for the distance of 18 mi. Each llama will carry about 100 lb. and will only make from 10 to 12 mi. a day, as the llamas get their entire sustenance from the coarse grass along the route and so must be permitted to stop and graze at frequent intervals.

Placer Tin Workings of Uncia

The streams near Uncia and Llallagua have long carried down much tin ore from the lodes previously described, and rich placer deposits have accumulated. Below the town of Uncia are two alluvial terraces where considerable placer work has been done. At the time of our visit the lower one was being actively prospected under the management of a brother of S. I. Patiño, but sufficient work had not been done to determine the average tin content of the gravel. A shaft 90 ft. in depth had been sunk through the gravels to the underlying slate. The water is taken from the lower workings through this shaft by means of a cowhide bag.

The richest gravels have been found at the contact with the underlying slates, but pay-streaks were also found at depths of 45 and 55 ft. The cassiterite pebbles are mainly less than 1 in. in size, yet a few cobbles as much as 4 in. diameter have been found.

The Huanuni mines of Patiño were purchased about four years ago from two companies which had long worked the same veins and fought each other. So bitter was the feeling between the workmen of the two companies that, it is said, a number of lives were lost in underground fights. The purchase price

[1] "Eng. and Min. Journ.," Vol. 100, pp. 461-464, 513-515, 555-558.

of the two properties is reported to have been approximately $2,000,000; as yet no dividends have been paid, and the future of the mines is somewhat uncertain. With the exception of one small operation, Patiño controls all the workable deposits of the Huanuni section.

The main workings are located on the south side of Mount Posoquoni, a mountain which rises to the elevation of 14,638 ft., situated along the line of the Patiño railroad, 30 km. from Machacamarca. Placers have been worked in the valley, while mining has been carried on through a number of tunnels. The lowest, the Socavon Patiño, has an elevation of 12,984 ft., while the highest, the Socavon Harrison, has an elevation of 13,460 ft.

The Geology of Mount Posoquoni

Mount Posoquoni is composed of gray to pink compact quartzitic sandstones with interbedded bluish-gray shales and shaly sandstones. An adjoining mountain is capped with a flow of porous porphyritic rhyolite, some of which occupies part of the depression between the two mountains. The mineralization of the region is unquestionably related to this extrusion of igneous rock, although no rock of this character has been encountered in the mines.

The sandstones and shales have been folded, jointed and shattered, yet in the main the strata have a north-south strike, dipping steeply to the east while the veins cut across the strata at high angles. In the vicinity of the veins the joints that are parallel to the veins may easily be confused with the bedding planes where the rocks are fairly homogeneous. The age of the rocks remains uncertain, as our efforts to find any fossils were unsuccessful, although we were told that occasional specimens had been observed.

Vein System Well Defined

The veins of the mountain are numerous, although only a few are persistent and have received names. The main vein is the Cataricagua, which was worked by open-cut almost at the crest of the mountain and has been located in all the lower tunnels with the possible exception of the Patiño. Its general direction is N. 55°-60° E., with an average dip of 45° to the southeast, although in places almost vertical. In reality it consists of two parallel veins which are, in most places, rather close together yet separated by a wall of firm rock that in one place had a maximum thickness of 450 ft. In the upper levels a steeply dipping offshoot from the Cataricagua is known as the Veta Medina. A third vein of importance outcropping lower down on the mountain is the Veta Tanitani. Many other veins have been worked with profit for short distances, but cannot be depended upon.

The veins vary greatly in width up to 30 ft. and also vary in their tin content, so that it is not profitable to stope in more than a small part of the drifts. The veins are shattered zones filled with sandstone fragments and cemented by the introduced ore and gangue minerals. The brecciation is more pronounced in the oxidized zone where the removal of the pyrite has left large open spaces and permitted fragments of the wall rock to break away. These have been cemented by limonite formed from the pyrite, yet less firmly than in the sulphide zone where open spaces, or vugs, are rather rare.

Some cross-faults have dislocated the veins, shifting all of them down the hill, but as yet these have not been thoroughly mapped. Indeed, careful geologic examinations are greatly needed in these mines as well as in many other Bolivian mines. So long as the operations paid good dividends the necessity for such work did not arise, and the mine owners did not object to expensive prospecting work prosecuted on the hit-or-miss plan.

Until recently only oxidized ore was mined, but this is now largely exhausted and in the future the sulphide ores must be mainly depended upon to maintain the production. A large tonnage of oxidized ore still remains, yet most of it is too low grade to be profitably mined. As is true in most of the Bolivian tin mines, no fixed line can be drawn between the oxidized and the sulphide ores. Even within the same vein some oxidized ores have been found at a depth of 300 m., and elsewhere sulphide ores are within 90 m. of the surface.

The oxidized ores are brecciated sandstone fragments cemented by cassiterite and so thoroughly coated with limonite that it is usually possible to distinguish between good ore and barren rock only by the specific gravity. In the best-grade ore some vugs lined with cassiterite crystals occur. Some specimens show small amounts of siderite and quartz. In the oxidized ore the highest values are found near the foot wall, probably due to the grains of cassiterite dropping there when released by the removal of the pyrite. That is, it is believed that this concentration is mainly, if not entirely, mechanical. The sulphide ores, as has been stated above, include fragments of sandstone with much pyrite, cassiterite, in places considerable sphalerite, and small amounts of quartz, tetrahedrite and siderite.

The tin values are about the same in both classes of ore. At the time of our visit the ore sent to the mill contained about 3% Sn, while the ore as mined probably contained about the same, although no data were available. When the ore reaches the surface it is hand sorted by Cholo women, who discard the waste rock and also pick out the pieces of rich ore, *guia,* which average 65% Sn and are shipped direct. Five to eight tons of *guia* are obtained monthly.

Mining Through Tunnels and Drifts

Mining is done entirely through tunnels, of which there are several now in use—the Hulman, Barreno, Tanitani, Harrison, Patiño, etc. The tunnels crosscut the veins with drifts run along the veins. Where the ore is sufficiently rich, overhead stopes are driven, or in a few places winzes are sunk. The walls remain unsupported in most places, but here and there a little timber is required or walls of rock are constructed for support. We saw many large open stopes, the walls of which had been standing unsupported for many years. The ore is trammed to the mouths of the tunnels by hand and dumped on the sorting-floor, whence the milling-ore goes down the hill to the concentrating mill by aërial tram.

The Patiño tunnel is the lowest tunnel and entirely in the sulphide zone of the veins which it cuts. At the time of our visit the tunnel had been driven to the point where the main veins should occur if the dip remained the same as in higher levels, but only small veins had been found. On one of these a winze had been sunk for purposes of exploration and some ore of average grade obtained. This was carried in rawhide bags by Indian boys to the tunnel level. These boys, some of whom were no more than 10 to 12 yr. of age, would carry 60 lb. of ore at a time.

On the floor where the Cholo women pick out the *guia* and discard the waste rock there is usually considerable high-grade material of very fine size. This is screened, and the finest grade is concentrated in hand jigs at the mouth of the tunnel, yielding a small amount of high-grade *barilla*. At the time of our visit a new mill was in process of construction. The two mills then in use were treating the oxidized ores by means of jigs and round concrete tables with revolving arms. In the new mill it was planned to treat sulphide ores which would first be roasted and then treated on jigs and tables A large amount of middlings was being sorted awaiting the new mill.

In the latter part of 1914 the Huanuni mines produced about 350 tons of *barrilla* and *guia* a month, while in July, 1915, the mills were treating about 300 tons of ore a day and the mines producing only about 100 tons of *barilla* and *guia* monthly. The old mill was making only about 65% recovery from 3% Sn ore, but it was hoped to materially improve this in the new mill. At Huanuni the miners in 1915 were paid 75 to 85c. a day, the boys 45c., and the women 30c. The miners were compelled to furnish the oil for their lamps, at a cost of about 6c. a day. These wages are about half what was paid before the European War demoralized the Bolivian tin industry.

Butte & Superior Mining Co.

Butte & Superior Mining Co. reports the following comparison for the first and second quarters of 1916:

	First Quarter, 1916	Second Quarter, 1916
Dry tons of ore milled	164,500	161,270
Average zinc contents, %	15.692	15.9709
Average silver contents, oz. per ton	6.844	6.7041
Zinc concentrates produced, tons	45.121	45.194
Average zinc in concentrates, %	53.122	52.9956
Total zinc in concentrates, lb.	47,938,530	47,901,445
Average silver in zinc concentrates, oz. per ton	22.018	21.8757
Mill recovery, % zinc recovered in concentrates	92.855	92.989
Mining costs per ton	$4.0341	$4.4971
Milling costs per ton	$1.5763	$1.7610
Total cost per ton, mining and milling	$5.6104	$6.2581

The tonnage is but slightly lower in the second quarter than the record first quarter, but costs were greatly affected by higher-priced labor and material. About the end of the quarter the No. 3, or new main hoisting shaft was connected through to the series of raises from the 1,400-ft. level, thus providing a continuous and permanently timbered shaft from the surface to that level. Construction of stations for this new shaft as well as that of foundations for new shafthouse and equipment progressed satisfactorily and will be finished well in advance of the delivery of machinery and steel building material, which will begin within a few weeks. Good progress was also made in sinking the new No. 2, or new manway, shaft and on construction of the new crushing plant and improvements in ore-bin facilities. Active development work was commenced on the 1,700- and 1,800-ft. levels, and while the extent of this work is not great as yet, the size, character and grade of the orebodies disclosed are fully as favorable as those of the levels above. Most of the work on these lower levels was confined to drifting, but even with the limited amount of crosscutting that was done, the addition to ore reserves was substantial and, taken together with the additional reserves blocked out on the 1,600-ft. level and above, constitute a total addition to reserves for the quarter about 30% in excess of the tonnage mined. Developments to the east and beyond the end of the Black Rock claim have been especially gratifying, and the outlook is that for some time in the future the additions to ore reserves resultant from the usual amount of development work done in connection with mining operations will be much more rapid than the reduction of these reserves through ore extraction. Owing to the urgent necessity of rapid progress in the construction of the new shafts and the large tonnage of waste necessary to be handled, it has been impossible to do any exploratory or extraordinary development work, and consequently such work as has been and is being done is confined to that necessary in regular mining operations.

The financial results of operations for the second quarter as compared with those of the first quarter, are as follows:

	First Quarter, 1916	Second Quarter, 1916
Net value of zinc concentrates (at mill)	$4,337,412.99	$2,879,568.45
Net value of lead concentrates (at mill) and of residues	264,302.75	246,341.54
Miscellaneous income	21,427.21	22,772.34
Total net value	$4,623,142.95	$3,148,682.33
Operating costs, taxes, etc.	1,068,203.27	1,086,653.00
Profits	$3,554,939.68	$2,062,029.33

After the payment of the regular quarterly dividend of 75c. per share and an extra dividend of $10 per share payable to stockholders on June 30, the company had net quick assets of approximately $3,900,000.

Sales of spelter have been made for future delivery covering a substantial portion of the production for the balance of this year. These sales have been made at a lower price than that applying to the second quarter.

Approximately one-third of the production of concentrates is sold under a contract, and settlement is made on the basis of current quotations of the *Engineering and Mining Journal* and these quotations have been at a very much lower price for the past quarter than the price at which future sales were made early in the year applying to current production. The average price for spelter used in determining the profits of the quarter is 11.41c. per lb.

"Wood Tin" Found in Nevada

A curious ore of tin, called "wood tin" from its concentric banding resembling the annual growth rings of wood, has been recently discovered in Nevada. An employee of the Rassell cattle ranch, situated 20 mi. north of Battle Mountain, a town on the Southern Pacific R.R. in northern Lander County, brought a sample of the ore into town, where it was eventually recognized by an engineer who had seen similar material in Mexico.

At the request of Senator Key Pittman, of Nevada, this ore deposit has been examined by Adolph Knopf, a geologist of the United States Geological Survey.

The ore, which is an oxide of tin, occurs in narrow veinlets in rhyolite lavas, which were erupted in middle Tertiary time. In places the veinlets are sufficiently numerous to form low-grade lodes, but because of the small development work so far done not much is known as to the size, extent and richness of these lodes. The indications of the stronger lodes, taken in connection with their geology, are, in the opinion of Government geologists, such as to warrant further exploration.

The deposits resemble closely those of the Mexican states of Durango, Zacatecas and Guanajuato, but are

wholly unlike all other tin deposits, most of which are associated with intrusive granites. Not only has the tin ore been found in place at a number of localities over a considerable area, but placer tin ore has been found in all the gulches heading in this area, and also in some of those at the north end of Shoshone Mesa.

Black Hawk Silver-Cobalt Ores

By Albert A. Leach*

Among the old silver camps of New Mexico that are being reopened since the rise in price of silver, is one that is likely to prove of interest to mining men because of its unique type of deposit. It is the old camp of Black Hawk, lying 12 mi. northwest of Tyrone in Grant County, which is interesting because of its deposits of nickel and cobalt arsenides in commercial quantities together with massive native silver and argentite. The ores are identical with those of Cobalt, Ont., and so far as I have been able to ascertain, are the only important deposits of this type in the United States.

The camp is an old one, having been discovered and worked in the early eighties, and intermittently up to 1893, when the mines were closed and allowed to fill with water. Since that time no work of importance has been done in the camp until recently, when the high price of silver again awakened interest in these long-abandoned camps.

During the short period of operations, the camp produced rather heavily considering that only the high-grade ores were handled. The cyanide process was not then in general use and no effort was made to treat the low-grade ores, which were thrown onto the dumps with the waste rock. The production of the camp is variously estimated. The United States Geological Survey gives the production of the camp as $1,000,000. The mine owners say this figure is too low and that the camp produced upward of $1,500,000. Much difficulty was experienced with high-graders and it is claimed that their operations were so successful at some of the mines as to rob the owners of all profits. Much of the ore was massive native silver which, it is stated, averaged the high-graders from $800 to $1,000 a sack.

The Black Hawk mine is the deepest in the camp, having attained a depth of 750 ft. on the vein. Its production is estimated at $650,000. The mine was closed in 1888 because of litigation and remained idle up to February, 1916, when the litigation was settled for a cash consideration and the property bonded to Minneapolis capitalists. Work was commenced at once on the mine, and the shaft is now being dewatered and retimbered preparatory to further explorations. The property is under the management of E. D. Lidstone, who is thoroughly familiar with the Black Hawk deposits, having made a careful examination of the mine prior to the shutdown. It is claimed that valuable ores were exposed in several places in the mine when it was closed and it will probably be producing steadily in a short time. A cyanide plant will be installed to treat the old mine dump and the low-grade ore.

Sufficient information is lacking regarding the mineral associations at this mine to enable a statement as to whether the nickel and cobalt ores were of any particular importance. The native silver here was very massive and was mined literally in sheets weighing up to 200 lb. Specimens of the ore resemble globs of melted coin, and one piece that went through the rolls (the nearest approach to a mill the old timers had), was flattened into a huge shaving-like slab of almost pure silver.

The Alhambra mine was an important producer of cobalt and nickel ores as was also the Old Rose mine. The Alhambra was worked to a depth of 400 ft. and made a production of $300,000. Its ores were chiefly native silver and niccolite carrying from 300 to 2,000 oz. silver per ton. Considerable smaltite was noted, also some millerite, all carrying silver. It is reliably stated that the niccolite ore streak was from 2½ to 3 ft. in width. The whole vein matter carries from 10 to 50 oz. silver per ton, but the native silver ore usually occurs in a chute, whose pay streak is from 8 to 24 in. wide and assays from 400 to 6,000 oz. silver per ton. Argentite occurs as filling in fractures and as crystals on the niccolite and spar gangue. Some hand specimens show niccolite, smaltite, millerite and crystals of argentite with crusty masses of erythrite and annabergite.

At the Old Rose mine, which was exploited to a depth of 200 ft., a large percentage of the ore was smaltite and chloanthite with high silver content. The upper stopes are said to have produced chiefly cerargyrite. The total production of the mine was about $150,000. Work was suspended before any real development work was accomplished and only a small part of the workings are now accessible.

The geology of the camp is simple. The country rock is pre-Cambrian gneiss cut by monzonite porphyry dikes which radiate from the main porphyry mass on the northwest side of the camp known as Twin Peaks. The veins usually parallel the dikes or are otherwise associated with them, and are of the true fissure type, ranging in width from 2 to 5 ft. They are all of the same general type, having a spar gangue, usually calcite or barite, and invariably present an intensely brecciated appearance.

There is considerable activity in the camp at present and some of the newer prospects are showing up so well they may be expected to enter the producing class any day. Some large chunks of very rich native silver float picked up on the east side of the camp recently have stimulated prospecting somewhat and the camp seems to be demonstrating its ability to come back.

*Chief geologist, Burro Mountain Copper Co., Tyrone, N. M.

Data on American Petroleum Oils

The Bureau of Standards, Department of Commerce, has just published a report which gives an account of the experimental work on which are based the expansion tables of Circular No. 57, "United States Standard Tables for Petroleum Oils." It gives a description of the methods and apparatus employed in the determination of the density and thermal expansion of petroleum oils from the various fields in the United States. Copies of this report, Technical Paper No. 77, may be obtained without charge upon application to the Bureau of Standards, Washington, D. C.

Manganese and Manganiferous Ores, the annual statement of the Geological Survey, Department of the Interior, 1915 is now available for distribution. During the year 801,290 long tons of manganiferous ores were produced in the United States.

Concentration at Inspiration--II*

SYNOPSIS—Though not the largest in capacity of the country, the Inspiration concentrator is undoubtedly the most uptodate in the treatment of low-grade chalcocite ores. Marcy ball mills grind the ore from the maximum 2-in. cube product of the Symons disks to 60% — 200-mesh at the rate of 400 tons per day. Total power consumption in grinding and transportation from mine bins to flotation cells is 10.729 kw.-hr. per ton exclusive of railway transportation. Other features of the mill are the drag classifier handling 800 tons daily, and the 200-ft. diameter Dorr thickener, the largest yet built.

The product of the Inspiration-mine crushing plant, loaded into cars for transportation to the concentrator, has been crushed to pass a 2-in. opening of the disk crushers, assays about 1.75% copper and has a moisture content of about 2.5%. Delivered to the concentrator, a mill recovery of 90% of the total sulphide is made, or about 85% of the total copper content.

Although the Inspiration plant is not quite the largest in the country it embodies what is today the latest practice in the treatment of low-grade chalcocite ores. In certain departments considerable pioneering has been done, which has resulted in marked economies, advantage of which will no doubt be taken where similar conditions make them applicable.

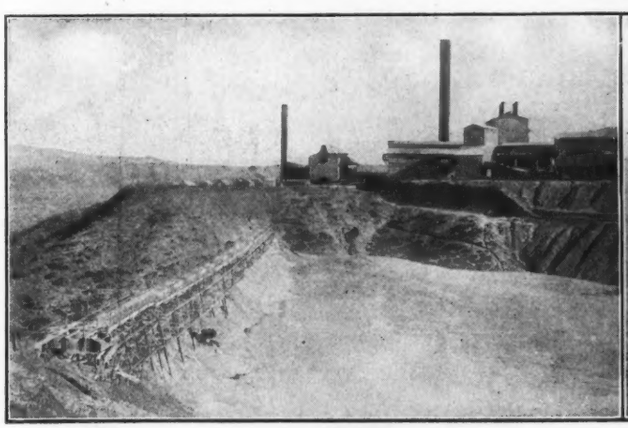


FIG. 1. TAILINGS STORAGE DAM

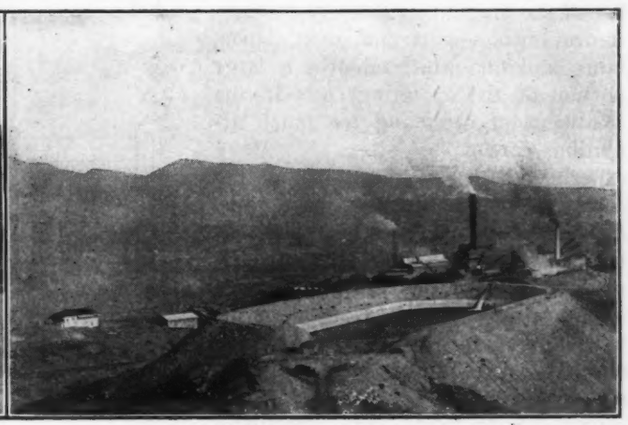


FIG. 2. WATER RESERVOIR, 3,000,000-GAL. CAPACITY

Model Grinding-Floor Space Economy

One of the most novel features relative to the layout of the plant is the arrangement of the grinding floor. With all due regard for the individual capabilities of the machines used, it is nevertheless a fact that the arrangement has been of paramount importance in bringing about the excellent results that are obtained. The following will serve to show that the method, besides being efficient in the work it is doing, is very conservative of floor space as well: Capacity of installation, 15,000 tons crushed per day from 2-in. disk crusher opening to 1½% on 48-mesh screen; area of grinding floor exclusive of motor platforms, 300x66 ft., or 19,800 sq.ft.; floor space per ton of capacity, 1.32 sq.ft.

The scheme can be briefly described as a parallel-series arrangement having two circuits, each with a ball mill and classifier in series, as shown in Fig. 3, being in parallel, the oversize from each classifier being returned to the mill opposite for regrinding. The mills are symmetrically arranged in two rows extending the length of the mill, as seen in Fig. 4, with their feed ends facing each other, just enough room being left between them to accommodate the Dorr classifiers. The classifiers act as elevators, and since all return is handled by them, the whole department is confined to a single level. There is a main runway between the mills above the classifiers, from which branch runways lead to the motors, between mills, etc. This arrangement gives the attendant an excellent opportunity to watch his machines and to reach them when necessary.

The conveyors bringing the feed to the mills are terminated in hoppers on a platform high enough above the mills to allow of a 45° slope for the launders leading to the feed boxes. The motors for driving the conveyors, classifiers, etc., together with their control apparatus, are located on this platform, shown in Fig. 4, as are also the control panels for the ball-mill motors. The switchboard attendant thus has a commanding view of the whole grinding floor. The floor is served by a 60-ton electric traveling crane which transfers the mills to and from the repair floors located at each end of the building. An inclined skipway along one side of the building serves the whole concentrator, the cranes on each floor making direct connection with it.

Ball Mill Grinds 400 Tons per Day

Experiments with the ball mill in the test plant led to the conclusion that 400 tons of coarse-crushing plant feed could be crushed with each mill in 24 hr., to 2% on 48-mesh screen and 60% — 200. Now that the Inspiration mill is running with all sections, it has been shown that the test figures were correct. Not only has 400 tons per mill been crushed, but with 18 sections running the average daily dry tonnage for the month of May was 15,358. A test section of two mills showed

*Excerpt from "The Inspiration Plant, Concentrator and Other Surface Equipment," by H. Kenyon Burch, chief engineer of the Inspiration Consolidated Copper Co., Miami, Ariz., to be presented to the September meeting of the A. I. M. E.

for a short period a tonnage rate of 1,000 tons per 24 hr. While this is by no means the average, it indicates what may be done in the future.

In view of the character of the ore and the fact that much of it is tough and more difficult to crush than the ordinary porphyry ores, the power consumption for the crushing plants is considered very satisfactory. The power consumption at the coarse crushing plant for the month of May, taking mine-run of ore and crushing it through gyratories and disk crushers, conveying and delivering to the railroad bins was 0.329 kw.-hr. per ton. This ore is delivered to the mill, and the average kw.-hr. per ton for the ball mills, including power for feeders, conveyors and classifiers, during the month of May was 10.4. Therefore the total power consumed per ton for the month of May on ore taken from the mine bins, crushed and delivered to the flotation machines was 10.729 kw-hr. One section of the ball mills has been in operation for a period of 10 days that has taken a power consumption of 8.53 kw.-hr. per ton. This amount added to the power used at the coarse crushing plant and that required by the conveyors gives 8.88 kw-hr. per ton of mine-run feed delivered to the flotation machines. The foregoing does not include the power required for transporting the ore by steam road from the mine to the mill. The crushing of the ore and its delivery for concentration is a matter of great importance and one which absorbs a large portion of the operating costs in the treatment of ores, and too much attention cannot be given it. Many experiments in connection with the crushing problem are now being conducted including tests of different types of steel for wearing parts and modifications which influence tonnage and cost of production. Ball mills have been equipped without the grates, and the results of the mills so equipped have shown that ball mills equipped with grates have advantages in increased tonnage and efficiency, so that the results of the experiments with the different shapes of pebble mills, subsequent experiments with the ball mills, and finally the monthly operation, lead again to the conclusion that a good choice was made in the selection of the present grinding machinery.

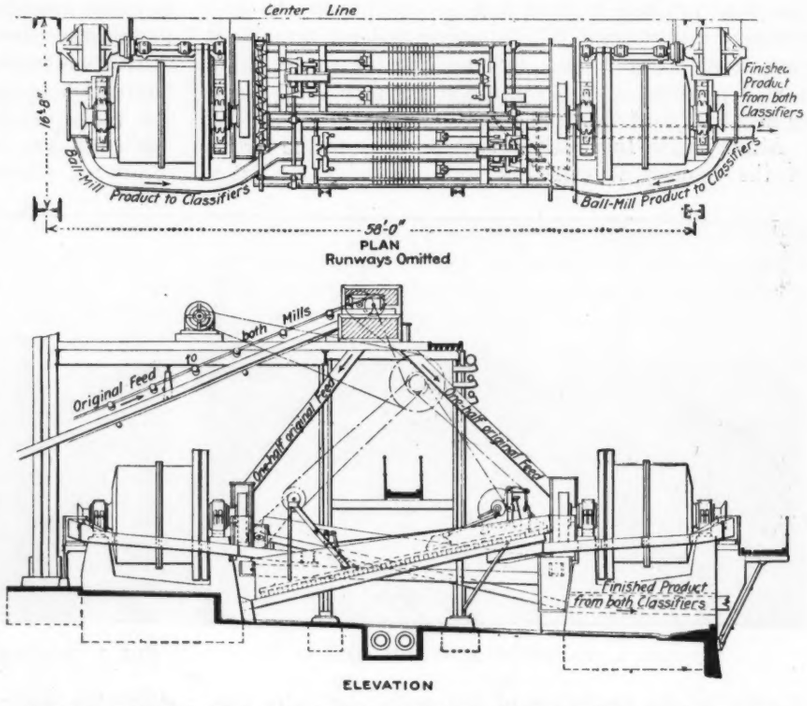


FIG. 3. MARCY MILLS IN CLOSED CIRCUIT WITH DORR CLASSIFIERS

The flotation department requires a large volume of low-pressure air. This is supplied by the four single-stage centrifugal compressors occupying one end of the flotation floor, shown in Fig. 5. The rating of these compressors is as follows: Capacity, 23,000 cu.ft. of inlet air per min.; discharge pressure, 5.75 lb. per sq.in.; revolutions per minute of impellers, 3,850; power of driving motors, 720 hp. The step-up to the impellers is made through Alquist gears. One unit of the four is held in reserve.

The drag classifier, which is being used on the flotation tailings for separating sand from slime, is the result of experimental work in the test mill. It is worthy of a detailed description not alone on account of its ability as a classifier, but also because of its large capacity. Except for the concentrates taken out by the flotation cells, each machine handles the entire tonnage of one unit, or 800 tons per day. The classifier consists essentially of two 18-in. belts, running parallel to each other and so arranged that the return belts run entirely clear of the settling surface, the rough classification being carried on sufficiently far below the surface so as to cause no disturbing currents. This is made possible by the use of four pulleys—one at the discharge end, two at the feed end (one vertically above the other), and one at the center near the bottom, where the slope begins. The distance between head and tail pulleys is 39 ft. The direction of travel of the return belts is horizontal, but on passing over the upper tail pulley it becomes vertical. The belt thus enters the pulp perpendicular to its surface. At the bottom of the tank its direction is again changed by the lower tail pulley to the horizontal. It travels thus to the center of the tank, where the belt with its load passes under another pulley and starts up a 20° slope toward the discharge end. All pulleys are of 32-in. diameter.

An adjustable overflow launder on each side of the tank, having a combined lip length of 52 ft., carries off the slimes. The effective settling area of the tank is 25x4 ft., or 100 sq.ft. The overflow is 5 ft. above the bottom horizontal belt. The two sets of submerged pulleys are mounted on shafts running in watertight bearings supported by the sides of the tank.

Tailing System Uses 200-Ft. Dorr Thickener

The conservation of the water supply is imperative, and it was for this reason that the extensive tailing-settling and return-water system was installed. The water is reclaimed at the concentrator and at the tailing dams. The equipment at the concentrator consists of three 100-ft. and one 200-ft. Dorr thickeners, and a large

dewatering box 17x109 ft. The overflow from the 80-ft. concentrate tanks is also turned into the return system. The dewatering box handles only the table tailing, the overflow from it being further settled in three of the 60-ft. Dorr thickeners. The overflow from all tanks goes to a 210,000 gal. concrete sump, from which it is pumped to a 60-ft. diameter steel tank of like capacity on the shop level above the concentrator.

The return-water pump equipment consists of four vertical triplex pumps direct-driven through gearing by 100-hp. synchronous motors. Each pump has a capacity of 2,000 gal. per min. and works against a head of 113 ft.

The water reclaimed from behind the dam, shown in Fig. 1, is at present handled by a 3,000-gal. two-stage centrifugal pump so arranged that it can be moved up a skidway as the water level of the pond behind the dam rises.

Dorr Thickener of 200-Ft. Diameter

The 200-ft. Dorr thickener is the largest single unit that has ever been installed and is therefore interesting from a mechanical standpoint. The thickener has not yet been erected, but at this time the designs are complete. It consists essentially of a reinforced-concrete tank 200

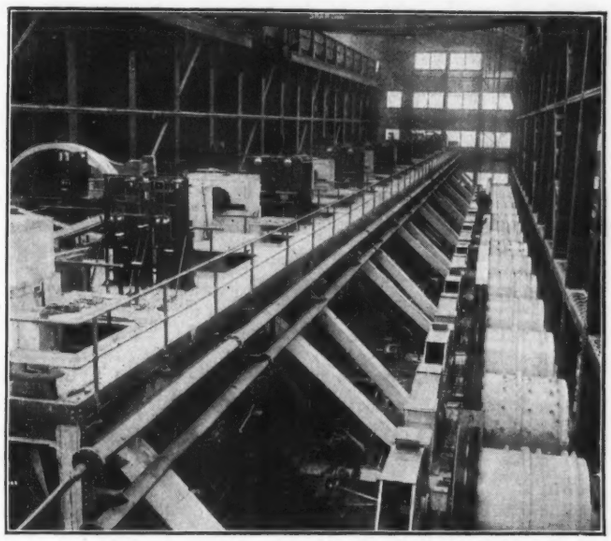


FIG. 4. BALL-MILL AND MOTOR-CONTROL FLOORS

ft. in diameter with the bottom sloping toward the center and having a depth at the outside of 7 ft. 3 in. The feed is delivered to the center of the tank through a launder supported by a 107-ft. steel truss. At the center of the tank is a steel-plate pivot, 18 ft. high upon which is mounted the drive drum. To this drum are fastened four short rakes (two 24-ft. and two 35-ft.) and the driving truss, which in turn carries two long rakes, 10 ft. apart and 100 ft. in length. The slope of the bottom of the tank varies, being $2\frac{3}{16}$ in. per ft. near the center, $1\frac{3}{4}$ in. per ft. for the length of the short rakes and the inner 16 ft. of the long rakes, and the remainder 1 in. per ft. The driving truss is completely submerged except the outer end, which rests on a circular track on the tank wall. The driving mechanism is placed at the outer end and consists of a 5-hp. motor connected through gearing to a single 24-in. plain tread driver. Two similar wheels are placed 10 ft. on each side of the driver to distribute the weight. The weight of the driving truss provides the necessary traction. The thickened product is drawn off through an annular opening at the center and the overflow at two diammetrically opposite points on the periphery of the tank.

Various possibilities were presented for furnishing water to this plant. To insure a supply, sufficient ground and water rights were early purchased at Wheatfields, about 12 mi. from the mill site and 1,000 ft. lower in elevation. Before developing this supply, however, it was decided to prospect on the flat below the tailing-storage site. Wells were sunk at various points until the best location had been determined, which is $2\frac{1}{2}$ mi. from the mill, 430 ft. lower and at the junction of two fair-sized drainage channels receiving their supply from the Pinal Mountains some 10 mi. away and 4,000 ft. higher. Here six wells have been sunk and 24-in. multi-stage turbine well pumps installed. These deliver through wooden pipe lines to a common steel sump tank having a capacity of 235,000 gal. Each well pump is belt-driven by a 150-hp. vertical motor and delivers a maximum of 1,200 gal. per min. Near the sump tank is the pumping station, which contains six 1,200-gal. pumps delivering into a common 20-in. pipe line. These pumps are horizontal, duplex, double-acting and are direct-driven through herringbone gears by 300-hp. synchronous motors taking current at 6,600 volts. Power for the pumping station and wells is supplied by the Inspiration-International power house. A 10-ton crane serves all parts of the building, and is an exceedingly useful addition for changing or repairing.

The 20-in. pipe line is 14,600 ft. long with a rise of 520 ft., and delivers water to the storage reservoir near the concentrator, shown in Fig. 2. From this reservoir water is delivered to all parts of the property. It is about 80 ft. above the concentrator, 1,200 ft. away and has a capacity of 3,000,000 gal. An oval excavation about 20 ft. deep was made in the top of a hill, and the sloping sides and bottom were lined with concrete. Two 14-in. pipe lines deliver the water to the concentrator, fully supplying all needs.

There are two separate outdoor transformer stations, one at the concentrator and one at the mine plant. As the two sources of power are received at different voltages, each station requires two sets of transformers. Both sources of power are 25-cycle three-phase, the Reclamation energy being delivered at 40,000 volts and that of the power house at 6,600 volts, both being stepped down to 2,200 volts for distribution about the plant. Both high-tension transmission lines are in duplicate circuits.

Skipway Connects Concentrator with Shop

All shop work except that for the mine is done at the concentrator shops, where a very complete equipment is installed, comprising some thirty different machine tools, all with individual motor drives, a 40-ton electric crane traveling the entire length of the building, the necessary facilities for locomotive repairs, several welding outfits for various classes of work, and a forge shop equipped with both oil and coal forges. The warehouse and electric shop and the locomotive roundhouse occupy opposite ends of the shop building. A standard-gage track through the center of the building permits running cars either into the shop or through the shops into the warehouse.

The shop level is 22 ft. above the upper floor of the concentrator. Communication is had between the two buildings by the inclined skipway which occupies one end of the concentrator, this connecting to the shops by a well through which material can be transferred either into the shops from the mill for repairs, or into the mill from railroad cars.

Switchbacks and Railway Equipment

The railroad facilities comprise the main line and several spurs, the total length being about 10 mi. All equipment is standard gage. The lines connect the several units of the surface plant; the pumping plant and the Live Oak Division, however, are reached via the Arizona Eastern. On account of the topographical conditions, it was necessary to use switchbacks to make the grade between the Arizona Eastern on the flat and the concentrator, some 400 ft. higher. The switchbacks provide for handling six cars. The extremes of grade and curvature on this line are 4% and 12° respectively. The line that connects the mine and the mill has a grade of 0.3% in favor of the load.

The six-wheeled, side-tank type of locomotive is used. Two are used on the mine line (these have a weight on

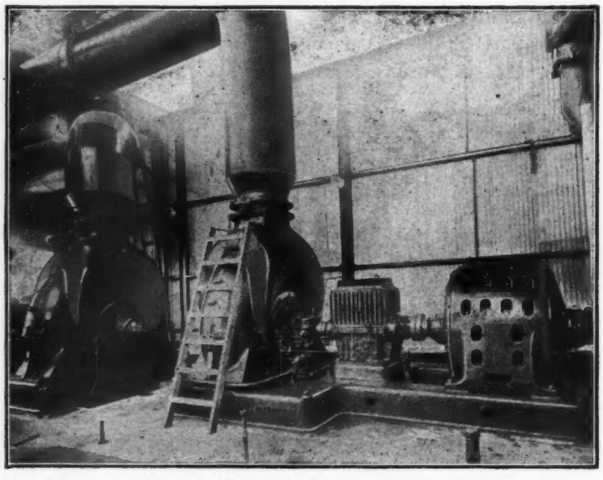


FIG. 5. CENTRIFUGAL AIR COMPRESSOR

the drivers when loaded of 112,000 lb.), and a third is used on the low line which has a corresponding weight of 200,000 lb., the latter being equipped with a superheater and Walschaert valve gears, oil burners being used on all. The ore cars are of the Ingoldsby patent dump type, have a capacity of 60 tons and a train length of 33 ft. They are of all-steel construction and weigh about 22 tons each.

Electric haulage on the mine division was at one time considered, but for the sake of uniformity of the several lines the idea was abandoned.

Sheet-Mica Production in 1915

The quantity of sheet mica, rough-trimmed and cut, produced in the United States in 1915 is smaller than that for any of the 12 preceding years, but the value of the product is the highest ever recorded. Statistics collected by the United States Geological Survey, recently published, show that high prices have produced a prosperous condition in the mica-mining industry in certain parts of the country.

The average price of sheet mica in 1915 was 68c. per lb., compared with 50c. per lb. in 1914 and 21c. per lb. in 1913. The total value of all sheet and scrap mica produced in 1915 was $428,769, a value exceeded, though but slightly, only by that for 1913. Scrap mica did not change much in value. North Carolina produced more than half the output, New Hampshire, Idaho and South Dakota being relatively the next largest producers. There was a small production of lepidolite (a lithia mica) in California, of clinochlore (a chlorite related to mica) in Georgia, and biotite in Colorado.

The report on mica in 1915, by W. T. Schaller, can be had by applying to the Director of the United States Geological Survey, Washington, D. C.

Deblooming Mineral Oils by Ultra-Violet Light

An interesting method of deblooming mineral oils (depriving them of their power of fluorescing) has recently been patented by T. T. Gray, of Elizabeth, N. J. (U. S. Pat. No. 1,158,205). The hydrocarbon to be treated is subjected to the simultaneous action of oxygen and ultra-violet light in a still. The temperature is somewhat elevated, from 50° to 300° C. according to the character of the oil, and pressures exceeding normal are also often used. Certain catalytic agents, such as finely divided or reduced metals and salts, also assist the conversion, caustic soda and potash being very active. As the ordinary trade method of detecting adulteration of animal and vegetable oils with mineral has been to look for fluorescence, it is evident some other test will have to be depended on if the Gray process becomes widely used.

Right to Follow Mineral Vein

By A. L. H. Street*

A zone or belt of limestone lying between a hanging and a foot wall of quartzite and through which a mineral streak containing orebodies can be traced is a vein, within the rules of law which permit the owner of a mining claim in which a vein apexes to follow it on its dip, held the United States Circuit Court for the District of Utah, in the case of Wall vs. United States Mining Co., just reported on page 613, 232 Federal Reporter. But it is also decided in the same case that where a fissure changing the formation of the land crosses a mineral vein, the owner of the claim in which the vein apexes is not entitled to pursue it beyond the fissure.

Tungsten Ore Exports From the Federated Malay States in 1915 included 234 tons of wolframite and 57 tons of scheelite, according to the annual report of Mine Warden W. Eyre Kenny. The exports were about the same as in 1914. Tungsten ores aggregating about 405 tons were imported from other countries and reëxported after treatment, and are not included in the above-quoted figures. Mr. Kenny remarks that it is not generally realized that tungsten ores do not occur in the Federated Malay States in defined deposits and that by far the greater bulk is found in small quantities, irregularly intermixed with tin ore and valueless matter. These facts render it impossible to obtain any large increase in output. Every effort has been made to stimulate production. Export duty has been suspended, special terms have been given to prospectors, and also as regards mining rights, though the high price that ruled would under different natural conditions have been sufficient to augment production.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Driving a 1,200-Ft. Raise

By S. Ford Eaton*

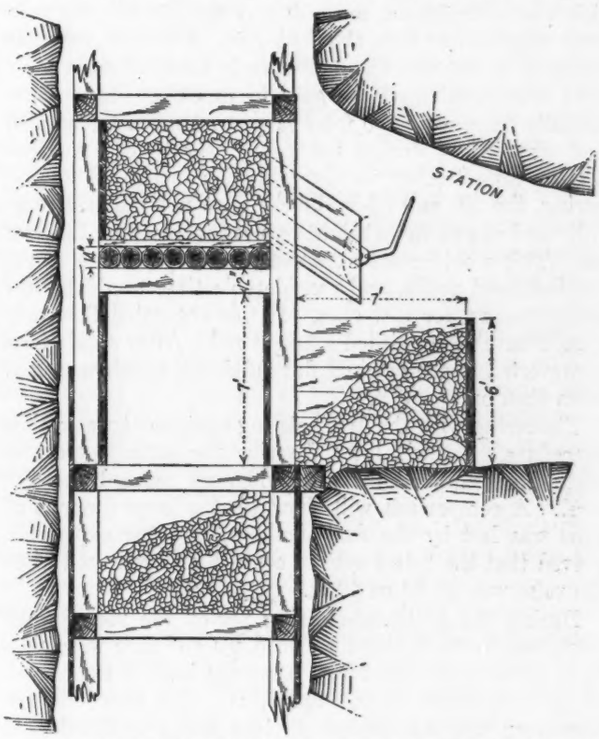
SYNOPSIS—Discussion of work as it progressed, giving the methods that had to be abandoned and the reasons why, and the new methods adopted. Least advance for one month for 10x20-ft. raise was 68 ft., and maximum advance was 128 ft.

The driving of a shaft raise was undertaken by contract for the Britannia Mining and Smelting Co., Britannia Beach, B. C., at its Tunnel Camp. Before and during the prosecution of this undertaking we were unable to avail ourselves of the advice or assistance of anyone who had had actual experience along this line on so large a scale. Needless to say, we encountered innumerable problems and difficulties, solutions of which we had to work out ourselves. Some of these were solved quickly, but others required considerable time. Changes in methods were made constantly during the first few months, progress being slow at times, but after the 400-ft. level was reached, consistent improvement took place. When our contract was canceled, owing to conditions caused by the present war, we were at about the 900-ft. mark, and to the best of my knowledge the completion of the work involved no further serious difficulties. Looking backward, we see what our lack of experience meant in the way of expense and lost time, so it is with the hope that someone else may be able to gain profit from a detailed account of some of our experiences that I submit these details.

The contract called for the driving of a raise 10x20 ft. in the clear, 1,200 ft. high; candles, all tools, blacksmith work and compressed air to be furnished by the company; contractor to supply powder, caps and fuse, labor for breaking ground and placing muck in the chute; company to remove muck, do all timbering, maintain pipe lines, furnish hoistmen and do all tramming. The original plan was to have the contractors' men work during the afternoon and graveyard shifts, timbermen employed by the company to work on the day shift. This plan was discontinued almost immediately owing to the timbering interfering with the drilling and vice versa. The contractors then put on three shifts of men doing both drilling and timbering, the time required for the latter being charged to the company. There were four of these men on each shift. My partner and I (the contractors) each came on for eight hours, but so arranged that we supervised the work for the major portion of each of the three shifts.

The raise was divided into two compartments and manway; the manway was maintained as such throughout, carrying ladderway, 4-in. air line and 16-in. ventilating pipe from a suction fan. The middle compartment was used as a chute and the remaining compartment for hoisting. Six-foot sets were used, 10x12-in. wall and end plates, 10x12-in. dividers, 12x12-in. corner posts, 10x12-in. wall posts and 6x8-in. center or guide posts. Sets were lagged with 2x12-in. material and middle or chute compartment lined with 3x12-in. The only serious damage that occurred to the timber consisted of two broken-wall plates and one broken divider. Chute lips were built of 3x12-in., equipped with halfmoon or arc gates operated with 5-ft. levers.

The first two sets above the tunnel-level station set were hoisted by hand, block and tackle being used. The first hoisting equipment consisted of a small air hoist, 5/8-in. cable and 600-lb. bucket. The cable passed under a 5x18-in. roller on the front wall plate of the station set, up through an 8-in. snatch block hooked on a chain around the center bulkhead piece and down to the bucket. The original bulkhead was of 12x12-in. timber 8 ft. long over the hoisting compartment and 5 ft. long over the manway.



METHOD OF BREAKING CONTINUITY OF ROCK CHUTE AT 200-FT. INTERVALS BY ROCK PENS AT STATION SETS

This bulkhead was laid from the dividers to the end plates. Over the chute compartment from wall plate to wall plate were placed three round timbers 12-in. diameter; one at each side to protect the dividers and one in the middle, forming a grizzly. This grizzly prevented large rocks from falling into the chute and causing trouble at the gate. It did its work so well that on a number of occasions after blasting, access to the raise was obtained only after hours of breaking and barring down some of these same large rocks. Continued blasting eventually destroyed these three round timbers and they were never replaced, the chute compartment being left open. Big-breaking ground was encountered at times, but was taken through the chute lips by barring and light bulldozing.

The first serious problem to engage our attention was that of the bulkhead and muck. After blasting a round of holes, the muck was found piled up over the manway end about 6 ft. high and about 8 ft. on the long bulkhead.

*Foreman Vantrent Mining Co., Vantrent, Calif.

In the desire to crowd the work, the men hurried back after the blasting and by working in the bad air their efficiency was so decreased that it required between three and four hours to clean off the muck. Later with a 30-min. allowance for the air to clear, this same type of bulkhead was cleaned in from 1¾ to 2 hr., and the men were in much better shape for the rest of the shift.

The length of time required for this operation caused us to devise a slanting bulkhead. Over the corner posts on the manway end were placed, on end, two 12x12-in. blocks, 20 in. long, and on these a 12x12-in. stringer, 9 ft. long was laid. Bulkhead pieces, 1 ft. longer than formerly used, were laid from this stringer to the divider and at the edge of the chute compartment and wedged in place to prevent sliding. The same was done with the longer bulkhead over the hoisting compartment, 30-in. blocks being used. The muck banked up to a certain extent on this type of bulkhead, but aided by the inclines, the men were able to clear it in about 45 min. However, the time required to construct and dismantle these inclines more than counterbalanced the gain in mucking time. Incidentally there were two more large timbers to be handled and disposed of during timbering operations. Another feature caused delay; in the confusion incidental to timbering, the 20- and 30-in. blocks were not watched carefully and one or more might be used in blocking the new set. This would not be discovered until the time to rig the bulkhead again, and considerable time would be lost sending down for new ones. It was suggested that they should have been painted a bright red. After a fair trial we reverted to the original flat bulkhead, which was used from then on.

Timbering with the first hoisting equipment was a slow procedure. I shall later describe the same operations with the equipment installed when we reached the 400 level. A comparison will show what a large amount of time was lost by the first methods, and our experience proved that the better system could have been used after the raise was up 35 or 40 ft.

During the bulkhead-clearing period the rock in the chute was naturally kept drawn down and care was taken to have the muck about 8 ft. below the level of the top set at the completion of this operation. The bulkhead was then torn up, the shorter sections being double-decked over the manway and the longer pieces laid crossways over the chute from wall plate to wall plate. During the period of using the grizzly and slanting bulkhead, this pile seriously discommoded the timbermen. A few trials enabled us to arrange these timbers so as to clear the daps for the posts and not require moving until the lagging was put in. At this time the bulkhead was raised to the top of the new set and timbering completed.

It was found advantageous to lay a flooring of 2x12-in. planks beneath both bulkheads, and since these were of different lengths from the regular lagging, they were easily kept track of and carried up with the bulkhead. These flooring planks prevented the final sifting of fine muck from falling down the raise, gave the men secure footing for handling the heavy bulkhead, and were used for temporary staging around the hoisting compartment during timbering operations.

Prior to cleaning the bulkhead—with the muck over the hoisting compartment furnishing a footing—a temporary hoisting stull of round timber 6 or 8 in. diameter was placed in position over the center of the hoisting compartment as close to the back as possible, giving an average clearance above the top of the last set of about 12 ft. A light chain was fastened around the middle of this stull. All but the center piece of the long bulkhead having been disposed of, the cable was pulled up and the snatch block moved up from the chain around the bulkhead timber to the chain on the hoisting stull. An eye-bolt was soon substituted for the chain around the bulkhead timber. For the first hundred feet this cable-hoisting operation entailed no difficulties, the crew of four being able to do it by hand. Later, the bucket was landed on a staging three sets from the top, the block and tackle attached to a sling above the hoisting stull, a special cable clamp bolted on the lead line of the cable 20 ft. down, the block hooked into this clamp and the cable pulled up the required distance to slip over the snatch block.

The posts were hoisted first in the bucket, two at a time, and placed in position. Next came the wall plates. For these the bucket was taken off and the cable hooked to a timber clevis in the lower end of the plate. The timber was held in a vertical position by a rope lashed around the cable and plate at the upper end. To aid in pulling back the cable, a 150-lb. weight was attached by chain and hook. The wall plate was then hoisted until the the upper end cleared the last set about 8 ft., the rope around the upper end then being removed. Further hoisting pulled the plate to a horizontal position across the bulkhead piled over the chute. The manway end was then placed on the corner post and the plate swung into position with the aid of the hoist.

The end plates and dividers were handled in the same way but, being shorter and lighter, were readily placed in position after being hoisted to the top. Wedges and blocks were then hoisted in the bucket, requiring about five trips. The set having been blocked, the bulkhead, grizzly, etc., were raised to the top of the new set, thus making room for piling and putting in the lagging. At first the bulkhead was lifted by hand, but later by the use of a hook and chain, this was done with the hoist. Eight trips were required for the 2x12-in. material. Next the center or guide posts were put in—one trip for these—and finally the 3x12-in. chute lining, taking six trips. When putting in this lining two pieces were left out on the manway and two on the hoisting-compartment side of the chute. Between these two openings 2x12-in. lagging was laid over the chute and on this was placed a short ladder which furnished convenient access to the top from either side. In the manway a small platform of 2x12 plank was maintained on the second set for storing various tools when not in use.

Drilling with Waugh Stopers

The timbering completed, the cable hoisting operation was reversed, platform and bulkhead placed in position and another round drilled. At this point another advantage of the 2-in. platform became evident. In the event of the back not being high enough for good drilling from the bulkhead, a section could be moved to one side and the leg of the machine set on the flooring. Thus a 12-in. variation in the height of the drilling platform was always available.

The machines used were of the 16V Waugh stoper, sprayer-attachment type using 1⅛-in. cruciform steel. The average round was 38 holes, ranging from 6½-ft. corner and end holes to 8-ft. cuts. An ordinary V cut

was used, two machines drilling in each end, the cut holes practically meeting over the chute. This style of round was used throughout. Holes were fired with time fuse and the entire round blasted at once. The amount of powder used for each round averaged 200 lb. of 40% low-freezing gelignite, which proved to be the most satisfactory. The drilling offered no serious problems, and with the exception of some hard ground encountered between the 400 and 600, was always done in reasonable time. During this stretch some rounds required from four to six shifts to drill. Frequently, however, rigging was pulled up with drilling completed and the machines down within an 8-hr. shift. The best time made on a complete cycle of operations—drilling, blasting, mucking and timbering—was a trifle over 24 hours. The aim was to break a 6-ft. round, thus advancing the back the height of a set of timber. The experiment was tried of breaking two and three rounds and then timbering, to save time in mucking off the bulkhead. Again the original plan was found to be the better, as the time required to put up and dismantle a substantial stull staging capable of supporting four men, machines, steel, water kegs, etc., was greater than that required to do the mucking.

Level stations were cut every 200 ft.; the 200, 400 and 600 being in the hanging wall and the 800 in the foot wall. The last was cut with no difficulty. In cutting the 200, we advanced the raise to about the 220-ft. mark, timbered to the level of the station, then came back and cut out the station with piston machines. The size of this hanging-wall face caused it to slab off rather badly, practically to the back of the raise, and the ground had to be watched carefully during the drilling and timbering. At the 400 and 600 the raise was carried only about 10 ft. above the station level and then the entire station was cut out. The raise was then advanced 10 ft. more and the raise station sets put in. Next, the back of the station was plugged off carefully with the stopers and the station timber put in. This method did away with the trouble previously mentioned.

Breaking the Continuity of Rock Chute

About the time we reached the first level at 200 ft., a chute problem developed. When drawing the muck, it was found that the rock did not move down the chute gradually except at the lower part. The upper 150 ft. subsided as a whole in a series of falls, the entire column of broken rock, roughly 6x7x150 ft., dropping a foot or two at a time. The effect of these blows or jars was received for the most part on the lowest sections of the chute. Eventually the dividers showed signs of giving way and the query naturally arose: "What will happen when we have a 600- and 800-ft. column of rock doing this?" It was finally decided to break the chute at each level, dividing the whole into units of 200 ft. Also the lower sections had to be reinforced by putting in spreaders or braces in both manway and hoisting compartments. Round poles about 8 in. diameter were placed between dividers and end plates, 12 in. from the wall plates and parallel to them. This decreased the area of the hoisting compartment considerably, but did the work. The break in the chute, illustrated by the accompanying sketch, was made in the following manner: The raise station set posts were 14 ft. long, and so 7 ft. above the dividers of the collar set were placed two 10x12-in. bearers, supported by 3x12-in. lagging spiked to the inside faces of the wall posts. Across the chute compartment on these two pieces was laid a bulkhead of 14-in. round timber. This was covered at right angles with a floor of 3x12-in. From this floor up the regular chute lining was put in except at the station side. On this side a chute similar to the one at the tunnel level was built. The fine muck from subsequent rounds formed a bottom on the bulkhead. Rock drawn from this chute fell to the floor of the station. Directly under this chute was constructed a three-sided pen extending out into the station 7 ft. from the raise station set, of the same width as the middle or chute compartment and 6 ft. high; 3x12-in. plank were used. The side toward the raise being open, rock falling on the floor of this corral formed an inclined bottom and rolled back into the chute compartment below.

This system made each 200-ft. unit independent of the others except that the first unit had to be pulled before the second could be drawn, the second before the third and so on. Occasionally some of the lining boards broke, but these were reinforced from the outside. About the fifth month of work the lining of the first two units was found to have worn very thin. The lowest chute was emptied, and a new lining 2x12 in., 12 ft. long, was spiked on over the old. The work was done from the bottom up, access to the chute being gained by knocking out two of the lining boards on the hoisting-compartment side every other set. The first unit having been repaired, the second was fixed in a similar manner. Breaking the continuity of the chute thus relieved the excessive strain on the timber. The reinforcing braces, however, were put in throughout. The completion of each unit meant another chute to be operated, but there was ample time to do all the necessary drawing during the drilling operations, the rock in the chutes being lowered sufficiently to accommodate that broken by the next round. Experience enabled us to gage this quite accurately.

Ventilation gave us practically no trouble. The 16-in. ventilating pipe was kept within 6 to 18 ft. of the bulkhead in the manway. The suction fan always being in operation, there was a steady current of air passing up the hoisting compartment, across the chute compartment in the last set and down the manway into the ventilating pipe. Just before blasting, the end of one air hose was fastened inside the chute compartment pointing upward and protected by blocks or wedges nailed around it. The compressed air turned on from this hose after the fuses had been spit started the smoke and gas downward, and immediately below the level of the bulkhead it was caught by the cross-current of air mentioned and carried away by the ventilating pipe.

Improved Hoisting Gear

Work was carried on for two months or so with the bucket, then we put into use what we called a "go-devil." This was simply a cage or framework of strap iron, 14x26 in. by 6 ft. 6 in. This "go-devil" traveled the same as the bucket, no guiding apparatus being used. Hoisting was facilitated to a certain extent, lagging, blocks, wedges, steel, etc., being sent up in larger quantities. At the time the 400 station was completed, new hoisting equipment was installed, consisting of a much larger single-drum air hoist, 3,000 ft. of ¾-in. cable and a cage. The cage was similar in construction to the ordinary mine cage with 32x50-in. floor space. A new head gear was constructed of 8x10 in. timber carrying a 22-in. sheave-wheel. A 22-in. traveling sheave replaced the roller at the foot of the raise. "Business picked up" immediately in the

hoisting operations. The head gear, called the "cathead," was kept on the second set from the top, supported by the wall plates. This allowed the cage to be pulled up level with the fourth set of plates from the top. A portable 12-ft. ladder hung by iron hooks or dogs from the "cathead" set enabled the men to climb from the cage to the hole in the chute lining. Four men proved to be just the right number to pass various tools and materials to the top. Timber-hoisting methods were now changed considerably. The increased weight of cable and cage prohibited the use of the hoisting stull and snatch block as before. The hoisting stull was put up, but with it was used a four-way block and tackle to raise timber from the cage to the top. The eight posts were first taken up at one trip, the two wall plates at one trip, end plates and dividers at one trip, blocks and wedges at one trip, 2-in. lagging one trip, and center posts and 3-in. lining at one trip. Six trips were required compared to thirty the old way. Inasmuch as the cage ran on guides, the hoisting time on each individual trip was materially reduced.

The wall plates naturally were the most difficult to handle. During the bulkhead-clearing operations, the hoistman, with one man to help him, stood these upright at the foot of the raise in the hoisting compartment, one at the rear and one at the front in diagonally opposite corners. By attaching a chain to the cage and hooking the lower end around the plate, it was readily pulled into this position with the hoist. The plates were stood on 3-in. blocks, which brought the lower end level with the floor of the cage when landed at the bottom of the raise. From this position they were readily moved onto the cage with the aid of a pinch bar. After being stood on the cage, the top ends were lashed to the hoisting cable, a separate rope being used for each plate. The cage was then pulled up until the upper ends of the plates barely cleared the "cathead." A short chain was hitched around the plates, one at a time, the block and tackle from the hoisting stull having been hooked to this chain and the timber was pulled up the remaining distance by hand. The landing of the plate was practically the same as described before. All the other heavier pieces were taken up from the cage in a similar manner, blocks, wedges, lagging and lining being passed up by hand.

Maneuvering the Hoist Cable

Hoisting the cable and the "cathead" was the next problem. By this time the weight of the cable had increased to such an extent that the old method employed was inadequate. A diminutive air hoist with about 100 ft. of ⅜-in. cable was installed on the 400 level. Two sets above the station set a snatch block was hung on one of the reinforcing braces on the same side as the lead line of the main hoisting cable. This brace had to be strengthened with angle braces. Another snatch block was hooked into an eye-bolt placed in the collar-set wall plate at the station level on the station side. The timbering having been completed, the ⅜-in. cable, which had a hook clamped on the end, was passed through these two snatch blocks and pulled down to the station level. One man riding on the cage did this adjusting. The cage was then pulled to the top and landed on two lagging thrown across the hoisting compartment. Next the hook on the ⅜-in. cable was hooked into a stout clamp placed on the lead line of the main cable. At a prearranged signal the big hoist was released and the main cable pulled up about 20 ft. by the small hoist; the brake was then locked on the latter. At the same time the crew at the top pulled up the slack in the hoisting cable by hand, and secured it with a rope. The block and tackle from the hoisting stull was then hooked into two chains passed around the "cathead," two being used to maintain a better balance, and it was pulled up another set and placed in position. To allow the "cathead" to pass the wall plates, it was found necessary to swing it diagonally across the hoisting compartment and tilt it slightly lengthwise so that one end moved up first.

The "cathead" having been placed in its new position, the cable hoisting operations were reversed, the cable being placed in the sheave wheel before the small hoist was entirely released. Slack was then taken up by the main hoist, the cage cleared, and the ⅜-in. cable taken down and wound up on the small hoist out of the way. When the 800-ft. mark was reached, the small hoist was transferred to the 800 station and operations were carried on as described before. This cleared the deck, as it were, for the drilling of another round. A little time was saved in hoisting steel, as all that was required for the usual round was hoisted at one trip. This was pulled to the top and passed by hand from the cage to the bulkhead. After passing the 600-ft. level the "cathead" began to show signs of strain. To relieve this, two iron stirrups were made to fit the 8x10-in. timber, and these were connected by two ⅞-in. turnbuckles to eyebolts placed in the middle section of the bulkhead. When hoisting the "cathead," these were of course removed, but not until the cage had been landed, as described heretofore, and replaced before the "cathead" again took the weight of the cable and cage.

This, as I look back on the work, was about the last of our problems, the advance of the raise then being a matter of routine. The poorest month's footage was 68 ft. and the best 128 ft. Station cutting interrupted the work too frequently to make a better record.

Bolivian Tungsten Exports

During the first three months of the present year Bolivia exported 11,950 Spanish quintals (1,211,730 lb.) of wolfram. The average price for 65% WO_3 was approximately $160. Of the total amount exported 75% went to the United States and 25% to Europe, according to the United States Commerce Report.

Oruro produced 69.52% of the wolfram, La Paz 19.14% and Potosi the remainder. The bulk of the shipments were made from the port of Antofagasta because of its direct communication with Oruro.

The above data refer only to the exportation and do not indicate the amount of production. It is said that considerable quantities of the ore are being purchased and stored until the close of the war in Europe.

Although antimony had always occupied a place of secondary importance in Bolivia, in the first three months of 1916 the exports amounted to approximately $1,500,000. The custom-house records show an exportation during this period of 6,524,000 kilos (14,382,950 lb.) of sulphate compound, whereas during January-March, 1915, the production was only 462,000 kilos (1,018,535 lb.)

Graphite exported from Ceylon after July 22 is to be subject to a government ad valorem export royalty of 3%, according to "Commerce Reports" of July 31. The former royalty was equivalent to 7.24c. per 100 lb.

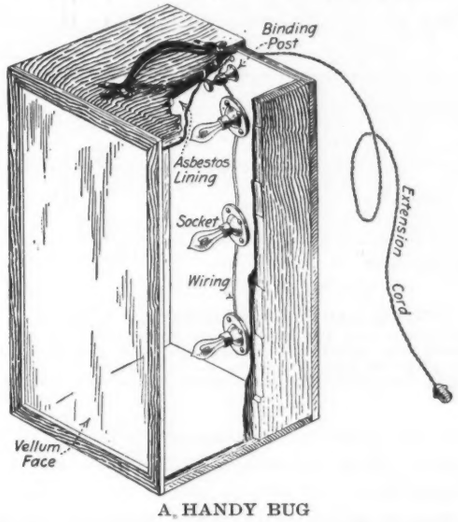
Details of Practical Mining

A Handy Light for Mine Surveying

By Albert E. Hall*

In carrying a transit line down a shaft it is usually desirable to make long sights, but this is often impossible on account of lack of light on the foresight. Where electricity is available in a shaft, this difficulty can be overcome very easily. The following description is that of a light used by the mine-surveying department of the Canadian Copper Co. With this light it is possible to make exceptionally long sights. At 800 ft. the sight is very clear, and by putting stronger lights in the bug after the limit of its present lights is reached, there is no reason why it should not be good for any sights necessary in mine surveying.

In the light described three 100-watt tungsten lamps were used, which were so arranged in a box constructed for the purpose that the light was concentrated within a



A HANDY BUG

small area. An ordinary powder box, such as is always available around a mine, was cut down so that the dimensions were about 24x12x8 in. It is more convenient to leave one side of the box off until the inside work has been completed.

As considerable heat is developed by the lamps and as some white material is needed in the inside to reflect the light, the box was lined with asbestos. After that had been done three sockets were put in place in the bottom of the box and wired in parallel. An extension cord was carried out through the back of the box and a plug attached to its extremity. If a long extension is necessary for any reason, it is better to make it in two parts. This can be done by putting a plug at the end of about 15 ft. of extension cord and making the next section of the extension with a socket at one end and a plug at the other. This arrangement makes it easier to carry the bug around in the mine.

*517 West 171st St., New York City.

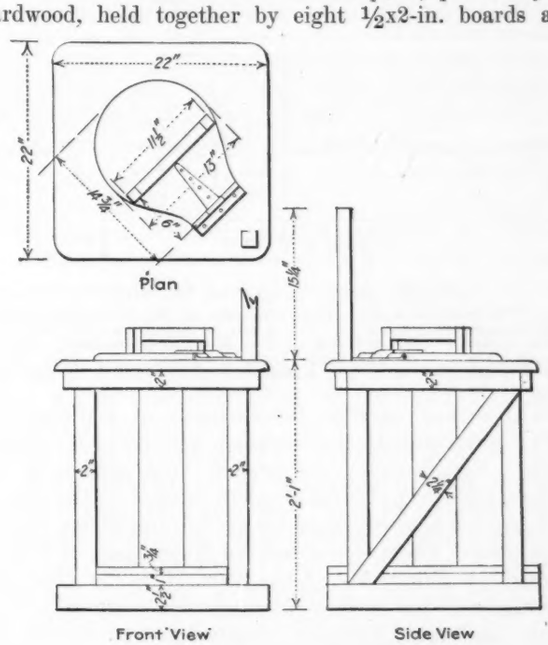
When the interior of the box has been finished, the remaining side is put on, having first lined its interior with a sheet of asbestos. Various materials have been tried for giving backsights and foresights, but it was found in the present instance that vellum, which is usually to be found around an engineering office, was an excellent material, so that its use is advocated for covering the front of the bug. A few holes bored for ventilation and a handle put on the top completed the light.

Sanitary Mine Latrines

By R. S. Bonsib*

A cheap mine latrine in underground workings is necessary, but owing to the nature of the workings, underground latrines such as are used by the United Verde Copper Co. or the Mond Nickel Co., are impractical in Virginia iron mines.

The following simple type has been found satisfactory. The frame consists of four 2x2-in. posts, preferably of hardwood, held together by eight ½x2-in. boards and



DETAILS OF CONSTRUCTION

braced by two pieces ½x2¼ in. The post at the back of the frame comes through so that it may serve as a handle by which the latrine may be moved from place to place, and it also serves the purpose of making the lid self-closing. An empty 100-lb. carbide can rests on three ½x2¼-in. cross-pieces and is held in place by ¾-in. boards cut out circularly so as to fit the bottom of the receptacle. Chloride of lime solution (1 lb. to 8 gal. of water) was found to be an excellent disinfectant, costing only about one cent per gallon. The cost of this closet including labor and material was only $2.78.

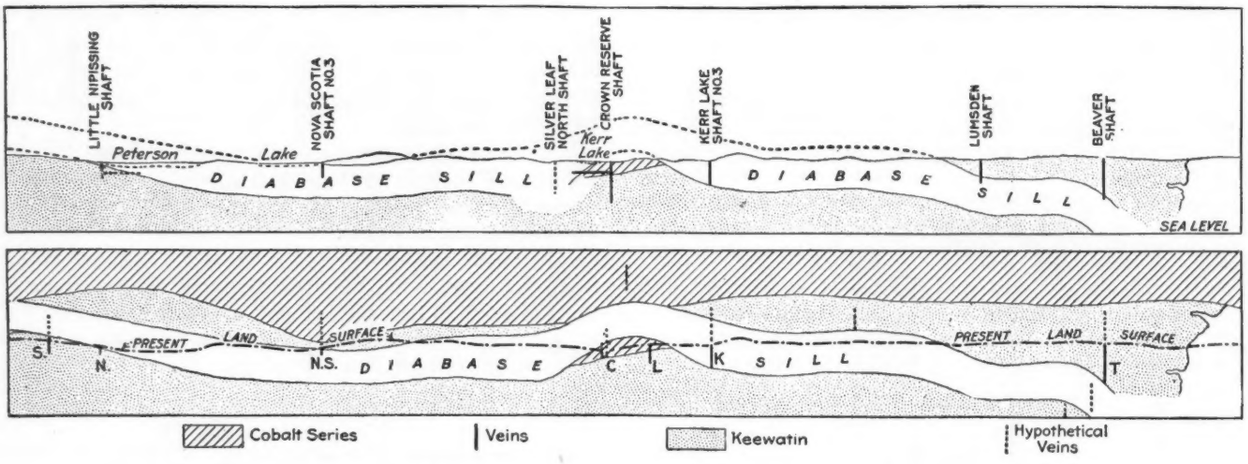
*Mining engineer, Low Moor, Va.

The contrivance has the advantages of cheapness, durability and utility, and is easily handled. It can be hoisted out of the mine in a bucket or skip, due to its small size.

Geological Explorations at Beaver and Temiskaming

The annual report of the year ended Feb. 29, 1916, of the Beaver Consolidated Mines, Ltd., Toronto, gives some interesting comments on geological developments at the Beaver and Temiskaming mines in Cobalt. The directors say the mine is approaching a most interesting period. Careful study of the geology of the Cobalt camp has revealed conditions which, in the early period of the camp, it was not believed existed. Upon the discovery of silver in Cobalt, the Provincial Geologist of Ontario, Dr. Willett G. Miller, made an exhaustive study of geological conditions in Coleman Township, and in 1904 proved beyond question the existence of a diabase sill which intrudes both the Keewatin and Huronian formations. Fig. 1 shows the present land surface of the Cobalt area; Fig. 2 gives a concise idea of this section of the country before the glacial period and before erosion took place. These are reproduced from report of Ontario Bureau of Mines, Vol. XIX, Part II, p. 5. The rock formation of the surface of the Beaver property is Keewatin, and the illustration clearly indicates that to the northwest the diabase sill has come through the Keewatin to the surface. The Beaver shaft was sunk in Keewatin formation and at a depth of about 500 ft. encountered the contact between the Keewatin and diabase. Along this contact, both above and below, the richest ore was found. Diamond drilling (the expense of which has been shared equally by the Beaver and Temiskaming companies) has proved the thickness of the diabase sill to be a little over 1,100 ft., consequently the lower contact of the Beaver property would be between 1,600 and 1,700 ft. from the surface. The illustration shows Kerr Lake shaft No. 3, which is about 1 mi. from the Beaver shaft. The Kerr Lake shaft was started in the diabase sill, encountering the lower contact at a depth of about 300 ft. from the surface. Several companies—the Kerr Lake, Lawson, Drummond, O'Brien and others—have mined along the lower contact, winning millions of ounces of silver. However, the lower contact has not been penetrated southeast of the Kerr Lake shaft except by the diamond drilling that has been done by the Beaver and Temiskaming. It would seem that the theory of eminent mining engineers, that the silver came up with this diabase flow which formed the sill and deposited along both the upper and lower contacts, has been proved by the ore that has been won by the Beaver and Temiskaming along the upper contact and by the Kerr Lake and other properties along the lower contact, the upper contact of these latter properties having been eroded away.

With the knowledge that the Beaver has two contacts, along the upper of which its richest ore was recovered, together with the knowledge that the lower contact has produced such immense amounts of ore at these other properties, the Beaver company deemed it advisable to explore the lower contact. The main shaft is down to a depth of over 1,400 ft., leaving about 200 ft. of sinking to be done before commencing the development of the lower contact.



GENERALIZED VERTICAL SECTION THROUGH THE PRODUCTIVE PART OF THE COBALT AREA

The section shows the relations of the Nipissing diabase sill to the Keewatin and the Cobalt series and to the veins. N represents a type of vein, such as No. 26 on the Nipissing, in the Keewatin below the eroded sill, and L a type such as one under Peterson Lake, in the Keewatin footwall, but not extending upward into the sill; K, a vein in the sill itself, such as No. 3 on the Kerr Lake property; T, a vein such as that on the Temiskaming or Beaver properties, in the Keewatin hanging wall and extending downward into the sill

The Beaver and Temiskaming properties lie side by side, and the same aggressive policy of development is being pursued on both. The Beaver is a large owner of stock in the Temiskaming company.

How To Avoid Tramming Accidents was one of three questions asked of members of the Safety Bear Club by the mine-safety department of the California Industrial Accident Commission. The best answer was as follows: "To avoid car accidents, see that the track is kept in good condition and do not place timbers too close to the track. If you tram by hand do not ride the car unless you have a brake and then always ride on the back end. Couplings made on a curve should always be made from the outside of the curve where there is more room. Keep your ears alert for passing cars when you are walking on the track. Cut out 'flying switches' underground. If you are driving a mule be decent to him; he might get bad and ditch you. It is bad practice to ride between loaded cars, because a car behind you might jump the track and jam into you." The answers are from working miners and published in Safety Bear Letter No. 4, issued by Edwin Higgins, chief mine inspector. The organization of the club and the circulation of the letters among the members has created an interest in mine safety that should reduce the number of fatalities in California mines.

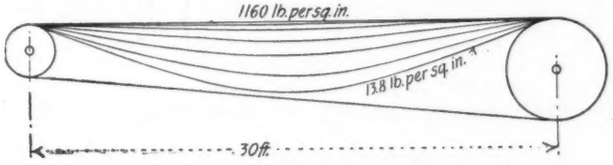
Details of Milling and Smelting

The Matter of Slack Belts*

By W. F. Schaphorst†

We often read about slack belts and their advantage over tight ones, but we seldom see real "figures" relating to such belts aside from the increased arcs of contact. The accompanying sketch shows how the arc of contact increases with slackness. In some cases I have known the increase to amount to over 30%, which is considerable, and is one of the reasons why a slack belt pulls so well.

The questions that remain unanswered are: What change in initial belt tension occurs with the increase of contact? Is that change worthy of consideration? In the figure I show a drive that has common everyday dimensions—30 ft. between shaft centers; a 3-ft. pulley driving a 6-ft. pulley; a belt that is 1 sq.in. in section (equivalent to a single-ply leather belt 4½ in. wide);



SLACK-BELT DIAGRAM

and I have varied the sag of the slack side all the way from ½ in. to 4 ft. The enormous change in belt tension is interesting and instructive, as shown in the table.

CHANGE OF BELT TENSION WITH SAG

Sag, In.	Corresponding Tension, Due to Weight of Belt, Lb. per Sq In.	Sag, In.	Corresponding Tension, Due to Weight of Belt, Lb. per Sq.In.
½	1,160	6	97
1	580	12	49
2	290	24	25
3	193	36	17.4
4	145	48	13.8

As a little study of the figures will indicate, the tension varies inversely as the sag in an almost exact proportion. That is, 1,160 ÷ 2 = 580; 580 ÷ 2 = 290; 290 ÷ 2 = 145 (see 4-in. sag); 145 ÷ 6 = 24⅙ (see 24-in. sag); and so on.

The formula used for solving any tension for any sag, any material (steel cables, electric cables or wires, ropes, suspension bridges, belts, etc.) and with any distance between points of attachment is

$$\frac{PL^2}{8D} + PD = \textit{tension in lb. per sq.in.}$$

where P equals the weight of the material under consideration 1 ft. long and 1 sq.in. in section. (For leather such as used in belts, P equals 0.43, the value used in obtaining the figures given); L equals length of span in feet; D equals sag, measured in feet.

It is hoped that this formula will prove useful in connection with problems of rope and belt drives. Offhand I should say that 1,160 lb. is too high an initial tension for a 4½-in. belt. It means over 250 lb. pull per inch width of belt, whereas we generally figure a useful pull of only 40 or 50 lb. per inch of width for the sake of safety—to "keep the belt from slipping." So why should we permit a tension of 250 lb. per inch of width on the "slack" side in order to get 300 lb. tension on the tight side? The useful pull then is 300 lb. — 250 lb. = 50 lb.

Traveling at a speed of 800 ft. per min., each inch in width therefore transmits $\frac{50 \times 800}{33{,}000} = 1.2$ hp. Do you get the drift of my argument? You will immediately see that I am not exaggerating common drives a bit when you recall the well-known belt rule, "One inch width of single belt running 800 ft. per minute will transmit one horsepower." I have been good enough here to permit 1 in. to transmit 1.2 hp. Initial tension of 580 lb. is too much also and 290 and 193. Why not permit 24-in. sag and reduce the tension to 25 lb.? If it can be done without belt slip, I say do it. Many a drive is operating successfully today with that much sag and without slip. In fact, I know of an installation where a 16-in. belt is transmitting 300 hp. at a belt speed of 2,340 ft. per min. The tension per inch of width is 265 lb., and yet the belt sags 30 in. If this belt were pulled up tight, figure for yourself how its useful strength might be wasted. In addition there is the bearing friction to consider.

The common method nowadays in putting on a belt is to "make a guess" as to the amount to be sliced out, take out "one inch or so more" for good measure and then force the belt onto the pulleys as tights as a fiddle string. We then get enormously high tensions, much higher than we think. According to the rule of thumb given, we can allow 185 lb. "useful pull" on our 4½-in. single belt, indicated in the sketch.

With a tension of 1,160 lb. on the "slack" side, we must therefore have 1,160 + 185 = 1,345 lb. pull on the tight side. The total pull, then on one shaft must be at least 1,160 + 1,345, or 2,505 lb. which, expressing it mildly, is enormous.

On the other hand, with a sag of 2 ft., the tension on the slack side is only 25 lb. and on the tight side it is 25 + 185, or 210 lb. In this case the total pull on each shaft is 25 + 210, or 235 lb., and just as much or more work is being done. We now see why there is such a difference in transmission efficiency. The friction of the slack-belt bearings is less than 10% of the tight-belt bearing friction; 235 ÷ 2,505 = 9.4%. Isn't that worth while?

If you wish to figure the power consumption of your bearings due to tight belts only, here is a fair formula: Horsepower lost in journal bearings as ordinarily fitted and well lubricated equals $\frac{0.000367dWN}{33{,}000}$; where d equals diameter of shaft in inches; W equals total belt pull, or load on bearing, in pounds, and N equals revolutions per minute. After weighing all these things, one

*Copyright, 1916, by W. F. Schaphorst.
†Engineer, Woolworth Building, New York.

cannot help being impressed with the folly of intensely tight belts, especially since they are so unnecessary. Imagine the much longer life of a belt stressed only 210 lb. as compared with being stressed 1,345 lb.

"Unreasonable," you may say. "If a belt can endure a pull of 1,345 lb. without breaking prematurely, it should be made to pull its full strength all the time." Well, there's some logic in that too, and rather than buy new and larger belts in installations that are being enlarged, I recommend increasing the stress in slack belts so long as they pull easily without slip. It may even be a good plan to install an idler pulley to prevent slip in extreme cases. All these points tend to prove the "beauties" of the slack belt. You can usually add more load on them. Tight belts, though, cannot be overloaded.

Automatic Oil and Acid Feeder

With the object of eliminating variations in the performance of flotation machines due to an irregular supply of frothing agent fed to the agitation cells, the machine described below was devised to feed regularly a given quantity of acid or oil into the ore stream.

The frothing agent is contained in the lead-lined tank *A*, Fig. 1, and regardless of the height of its upper level so long as it is kept above the minimum line *x-x*, a uniform quantity is fed into the mill-stream supply pipe *B* via the lead launder *C* by the small lead buckets *D* attached to the revolving bronze disk *E*. This lead launder clears the path of the buckets, as best shown in the plan, Fig. 2, through the manner of its support by the bracket *F* and its outward curve as it approaches the pipe *B*.

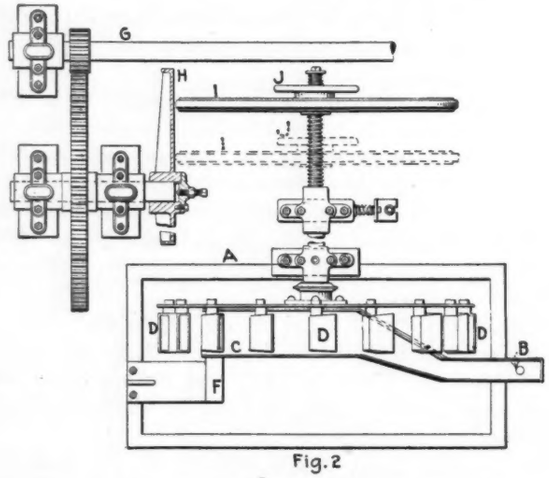


Fig. 2

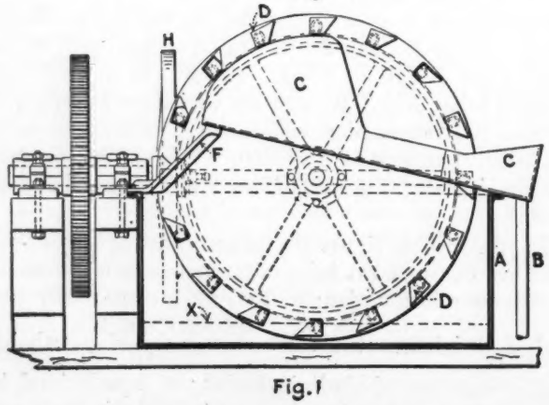


Fig. 1

AUTOMATIC OIL AND ACID FEEDER
Fig. 1—Elevation. Fig. 2—Plan

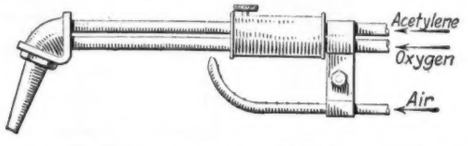
The bucket-carrying disk is rotated from the lineshaft *G* through the gears driving the friction disk *H*, which in turn is pressed by the friction wheel *I*. The latter is adjustable to any point along the threaded portion of the shaft, it being obvious that the closer the point of contact of *I* and *H* approaches the hub of the latter, the slower the speed of friction wheel *I*. This wheel does not rotate upon the threaded portion of the shaft, since it is feathered to it and hence revolves with it. Adjustment of this wheel to any point along the threaded portion of the shaft is effected by hand rotation of the wheel *J*, which is loosely held to the hub of *I* by an annular ring revolving in a groove. A pin lock holds these wheel hubs together immovably, insuring against accidental changes of speed. Whenever it is desired to change the supply of frothing agent, a slight movement of the lock pin allows wheel *J* to be rotated by hand and move the friction wheel to a new point of contact on the friction disk, thereby effecting the desired changes in the speed of feeding.

The hand adjustment of wheel *J* can be made while running, so that it is not necessary to shut down to make changes in the supply of frothing agent.

This machine is the invention of Albert Campbell, of Anaconda, Mont., granted patent No. 1,190,721 on July 11, 1916.

Oxyacetylene Welding Kink

An oxyacetylene welding equipment, such as has been widely and successfully used heretofore, says J. D. Cumming, in *American Machinist,* Aug. 17, 1916, is described as consisting of an air hose and a short piece of plugged pipe with a number of small holes drilled in it. The pipe is laid on the bench or work under the hands of the welder, and the air protects his hands and face from the intense heat. The disadvantages of this device are that it does not follow the movements of the worker, is easily shifted or knocked off the bench or work and, if laid on the heated article being welded, tends to cool it.



OXYACETYLENE WELDING TORCH WITH PIPE
An apparatus easily handled

The illustration here shown is an arrangement consisting of a ¼-in. pipe connected by a light hose to the air line. The pipe is bent to surround the hand of the welder and is fastened by a light bent-iron clip to the torch. By this means the welder can keep his hands and face cool without any of the disadvantages of the other method. The arrangement works well and is satisfactory from all points of view.

A Method of Correcting Worn Platinum Weights is given in "Chemical Abstracts," July 20, 1916. A sufficient amount of a 1% solution of $AuCl_3$ is decomposed by heating with a small flame on the light platinum weight until the weight of the deposited Au a little exceeds the shortage. A trace of borax is then added and the weight heated momentarily in a blast lamp, after which the weight is ground down to the proper size on a carborundum stone.

Company Reports

Barnes King Development Co. reports a loss of $26,157 during the second quarter of 1916, giving a loss for the first six months of the year of $145. During the period the cash was reduced from $185,000 to $60,000 by the loss noted and by payments on the property.

The Lake Milling, Smelting and Refining Co., Michigan, reports a readjustment of capital stock which makes the holdings more nearly conform to the stamping requirements of the holders. Control is now held as follows: Allouez, 36,164 shares; Isle Royale, 18,836; Superior, 18,836; Centennial, 16,164; Hancock, 10,000 shares. The Lake Milling company now has six heads at Mill No. 1, Point Mills, and two heads at No. 2, formerly the little Tamarack mill, Hubbell.

Consolidated Interstate-Callahan Mining Co., operating in Idaho, reports for the quarter ended June 30, 1916, a total tonnage mined of 37,217, a total milled of 32,782 tons and a zinc production of 16,853,320 lb. The crude shipping ore carried 52.08% of zinc, the milling 26.08%, while the average silver content of the crude ore was 20.88 oz. per ton, the milling ore 2.20 oz. per ton. The total tonnage of crude ore and concentrates shipped was 18,069. The average zinc content of the concentrates was 48.51% and the silver contents of the tonnage shipped was 20.71 oz. per ton. The mill made a recovery of 80.99% at a cost of $1.492 per ton. Mining costs were $4.972 per ton. The three-compartment Interstate shaft has made connection at No. 6 level with the Amazon-Manhattan workings and will be continued to the 700 level, which it should reach in August. Plans are being developed for the installation of a flotation plant which should add approximately 400 tons per month to the company's production.

Schumacher Gold Mines, Ltd., operating at Porcupine, Ont., was organized in 1914 to take over 160 acres bounded on the west by the McIntyre and Acme mines in the Porcupine district of Ontario. A mill of 140 ton's capacity was begun in April, 1915, and completed in September, 1915. To June 30, 1916, the company reports 820 ft. of sinking, 2,570 ft. of drifting, 3,505 ft. of crosscutting, 400 ft. of raising and 1,585 ft. of diamond drilling. Ore reserves are estimated at 64,900 tons valued at $396,700. This includes both material underground and on the dumps. To July 1, 1916, the mill had treated 30,120 tons of ore at an operating cost of $131,719 with a bullion recovery of $161,949. In addition solutions were estimated as being worth $1,703. After allowing for interest charges a working profit of $31,933 is shown to July 1, 1916.

La Rose Consolidated Mines Co., Cobalt, Ont., reports for the year ended Dec. 31, 1915, a production of 1,135,143 oz. of silver at a cost of 31.64c. per oz. and a return of 50.88c. There were 254.6 dry tons of silver-cobalt-nickel ore, 3.6315 tons of nuggets, and 1,482.3 tons of concentrates shipped, assaying 1,229.8 oz. per ton; 19,282.8 oz. and 464.5 oz. respectively. Mining costs were $108.01 per ton of shipping ore; concentration, $82.15; marketing expense, $5.45; corporation and traveling expense; $0.85; total, $236.34. In addition there were advances to the University Mines, Ltd., amounting to $2.52 per ton and credits, ground-rent, discount, royalty of $23.75 per ton of shipping ore. There were 54,404.8 tons of ore milled, carrying 15.28 oz. of silver per ton, from whichh 1,382.1 tons of concentrates were produced, carrying 459 oz. per ton. The tailings carried 3.49 oz. per ton, or an extraction of 76.70% on a 39.2:1 concentration. There was 4,393 ft. of underground work done during the year. On Jan. 1, 1915, ore reserves were estimated to contain 860,000 oz. in mine and dumps. The year's production was 1,135,000 oz., but there was on Jan. 1, 1916, only a small amount of rich ore in sight in pillars and about 10,000 tons of milling ore.

McIntyre Porcupine Mines, of Schumacher, Ont., report a profit of $327,524 for the year ended May 31, 1916. From the treatment of 105,758 tons having a gross value of $7.71 per ton the total recovery amounted to $779,991, or $7.37 per ton, indicating an extraction of 95.6%. Since the beginning of milling operations in 1912 to date, the property has produced $1,800,241 in gold bullion, which was recovered from 237,891 tons of ore averaging $8.10 per ton. Development work consisted of 99 ft. of stations, 302 ft. of shafts, 26 ft. of sumps, 4,006 ft. of drifts, 1,162 ft. of crosscuts and 989 ft. of raises, making a total of 6,585 ft. for the year. Diamond drilling amounted to 5,787 ft. To date, 25,672 ft. of development work and 10,337 ft. of diamond drilling have been performed on the property. The total cost per ton was $4.28, as shown by the following table:

OPERATING COSTS

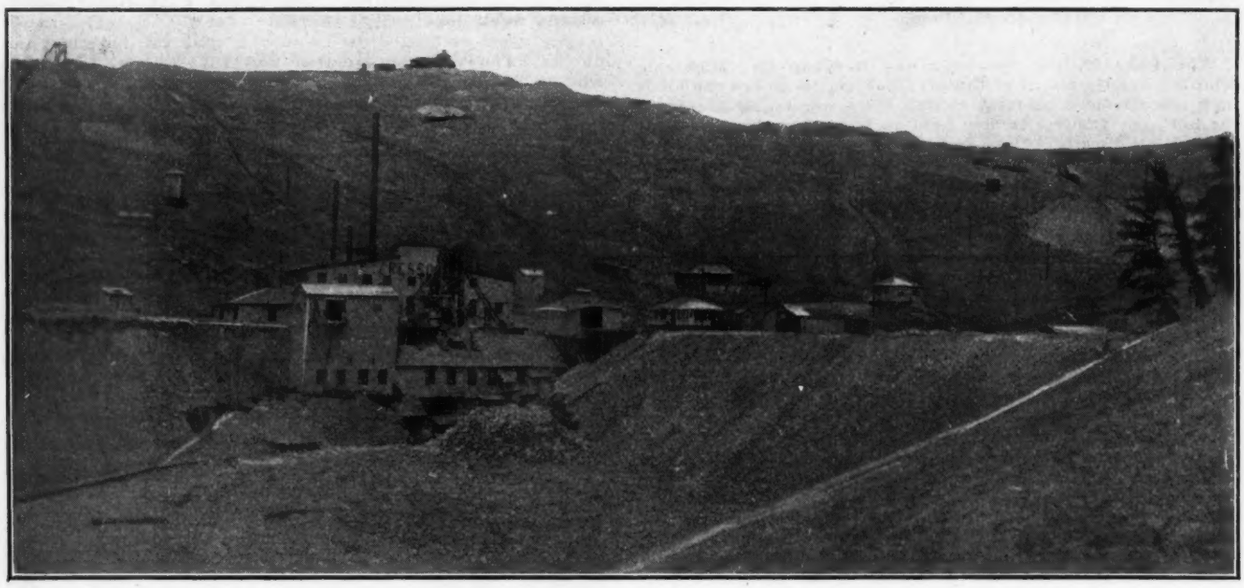
General Charges:	Cost per Ton
Taxes, insurance and workmen's compensation	$0.1582
Administration and head-office expense	.1513
Office and storehouse expense	.1586
Interest and exchange	.0221
Operating dwellings	.0027
Discount on bonds sold	.0851
Camp maintenance	.1023
Roadwork and surface improvements	.0297
	.7100
Bullion-marketing charges	.0427
Mining:	
Exploration	.0726
Development	.8064
Breaking and stoping	1.6326
	2.5116
Milling	.9682
Maintenance of plant and buildings	.0491
	$4.2816

ANALYSIS OF MINING COSTS AT McINTYRE PORCUPINE MINES

	Transportation of Ore	Stoping	Drifting	Cross-cutting	Raising	Sinking Stations Sumps	Total Cost	Cost per Ton
Labor	$2,898.03	$46,774.76	$14,997.93	$4,281.83	$5,404.85	$11,630.71	$85,988.11	$0.8132
Supplies	313.80	22,904.16	7,629.17	2,244.54	2,281.30	1,253.18	36,626.15	.3063
Hoisting and tramming	.....	44,703.72	8,281.24	2,255.40	2,297.29	2,457.53	59,995.18	.5673
Timbering	.....	13,444.69	809.47	177.72	917.71	2,113.74	17,463.33	.1650
Rock-drill maintenance	.....	3,855.95	664.46	180.10	184.95	239.25	5,124.71	.0495
Air supply	173.03	17,573.02	2,838.56	801.29	1,946.77	1,285.46	24,618.13	.2328
Sharpening and handling steel	.....	10,394.34	1,740.07	488.64	481.29	448.43	13,552.77	.1281
Tracklaying	.....	.....	852.64	303.15	.....	.....	1,155.79	.0109
Pumping and ventilating	.....	2,217.24	348.46	103.98	100.30	116.16	2,886.14	.0273
Assaying and sampling	.....	3,961.31	1,218.16	361.24	286.95	192.11	6,019.77	.0569
Surveying and engineering	.....	3,447.17	579.67	157.73	156.90	173.34	4,514.81	.0427
	$3,384.86	$169,276.36	$39,959.83	$11,355.62	$14,058.31	$19,909.91	$257,944.89	$2.4390
Exploration	.....	.....	.....	.....	.....	.....	7,677.04	.0726
							$265,621.93	$2.5116

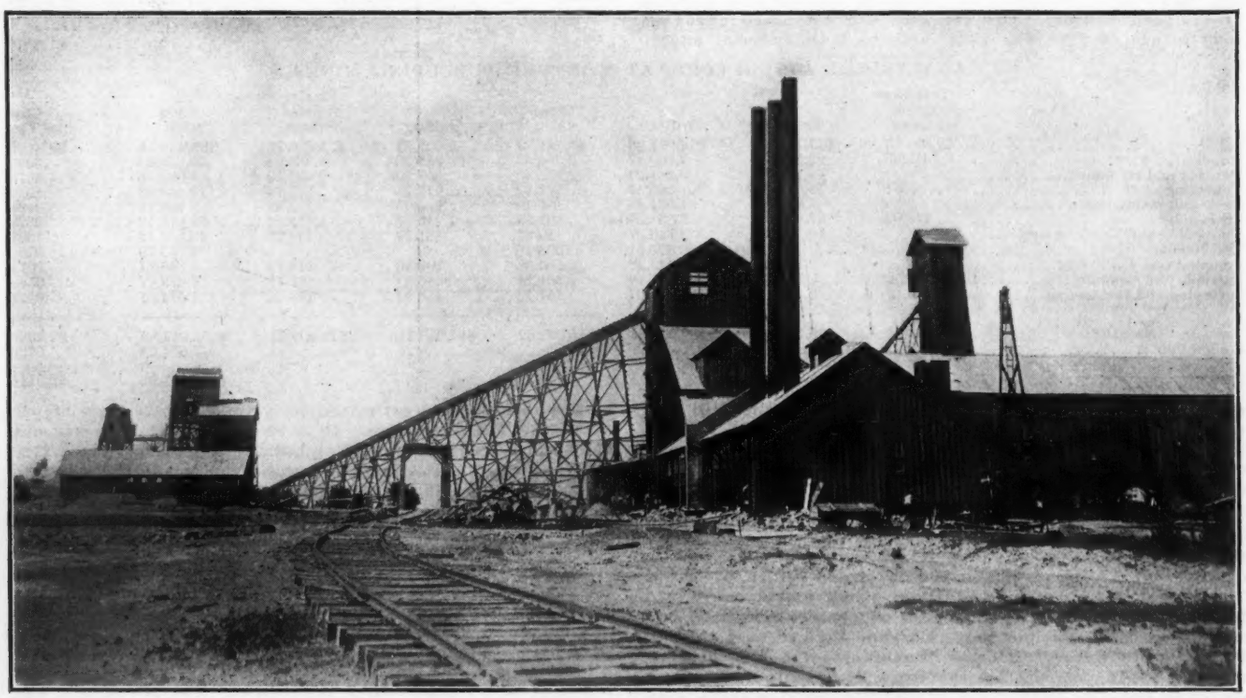
Ore reserves are estimated to contain 201,920 tons of ore averaging $11.12 per ton. It is stated that the worked-out blocks in the estimates of March 31, 1915, have produced 21% more ore than was estimated in these blocks. In the estimate just given, the veins in No. 9 shaft have been extended to 40 ft. below the 600-ft. level. No allowance has been made for extension of veins beyond the present working faces. No. 5 vein has been extended to 100 ft. below the 700-ft. level, three diamond-drill holes having penetrated the vein below the 700-ft. level and indicating that ore will continue to that depth. An extension of 35 ft. has been allowed beyond each face in ore on this vein. The orebodies in the contract zone have been extended 50 ft. below the 700-ft. level, and in 714-715 drifts a width of 11 ft. has been substituted for the width of 62 ft. shown in 7 D crosscut. The advance in the price of all supplies has increased the milling cost 16.5%. Expenditures on permanent additions to plant amounted to $93,630, of which $48,062 was for new mill addition.

Photographs from the Field



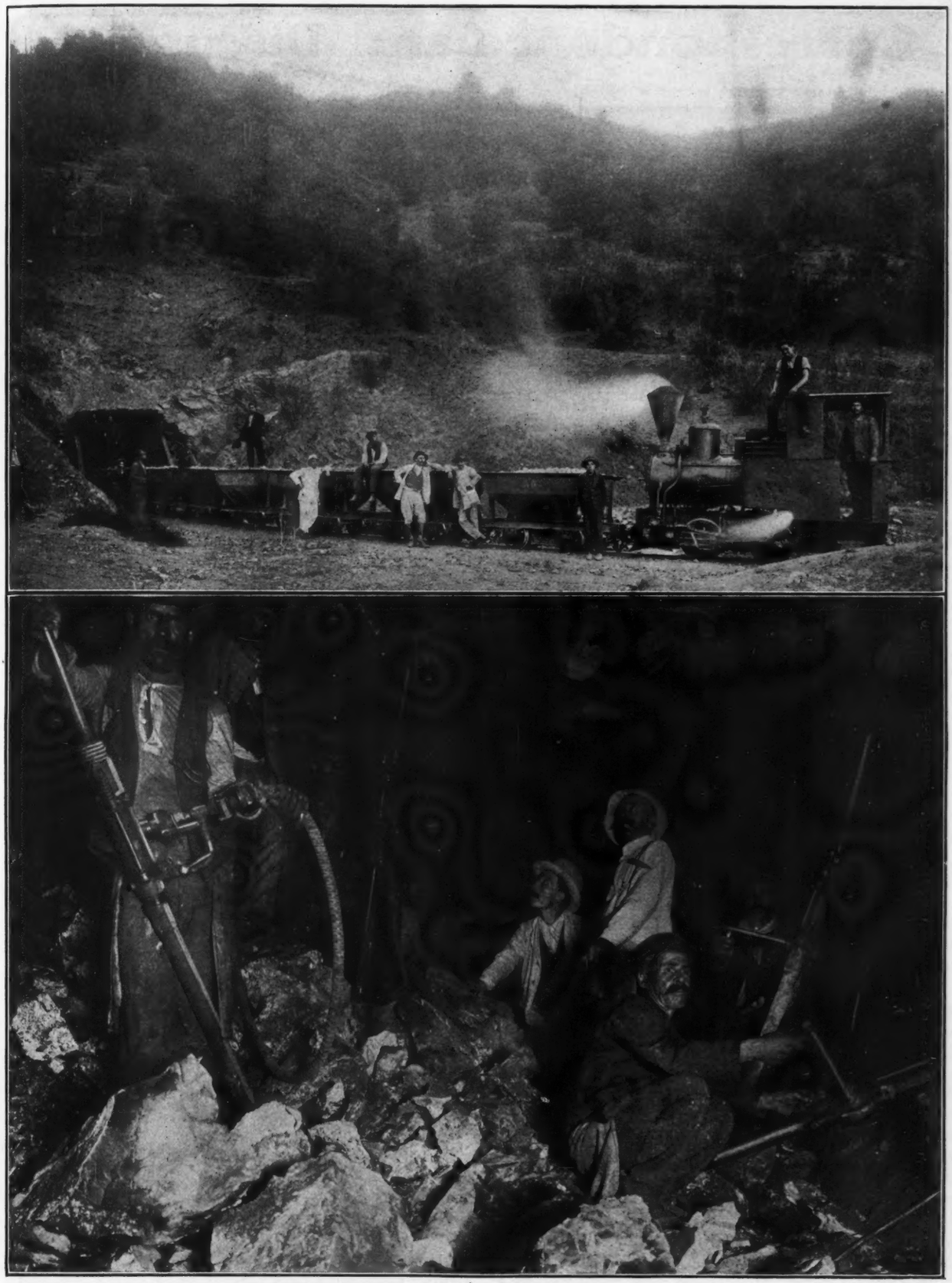
THE CRESSON, ONE OF CRIPPLE CREEK'S FAMOUS GOLD MINES

Control of the Cresson Consolidated Gold Mining and Milling Co., owning the mine of vug fame, recently passed to a group of Colorado men. Its shares have lately been in demand at about five times their par value



A RECENTLY COMPLETED MILL IN THE JOPLIN DISTRICT

The Onamena No. 3 plant was completed about Aug. 1. It is in the Duenweg section of the southwest Missouri zinc field



TWO VIEWS AT THE COPPER MINES NEAR NALTAGUA, CHILE

Portal of the tunnel on the San Antonio and an ore train ready to be transported by oil-burning locomotive to the works of the French company operating these mines. Air drills at work in the mines of the Société des Mines de Cuivre de Naltagua

Correspondence and Discussion

Revision of Mining Laws

Being intensely interested in the mining laws, particularly regarding location and its details, I take the liberty of expressing my views on your editorial in the Aug. 26 issue of the *Journal*. Certain of the paragraphs ask questions that I am not prepared to answer, but the following ones, on which I touch, I should be very much interested in seeing discussed further.

6. The number of claims locatable by one person or association should be unlimited. What plausible reason is there for limiting this?

10. What reason should there be for allowing more than three months' time for recording location? A year's lapse or more might indicate one's lack of interest.

11. The annual assessment should be $5 per acre, as it is today.

12. It should be permissible that an equivalent sum of money could be deposited with (not paid) to the United States Land Office in lieu of the performance of assessment work until such time as the holders are in a position to spend an accumulation of money (amount to be left to the holders of claims) at one time, thereby deriving more benefit out of the assessment work. This is especially the case where property is inaccessible and where it is costly to get work started for such a small expenditure as $100, or where the owner is away for several years and cannot entrust the work to anyone, or where $100 spent, for instance, on one claim would do absolutely no good toward development or proving a location.

13. A person or association holding a group of contiguous claims should be permitted to do the assessment work upon any one of them and thereby hold the group, unless paragraph 12 be substantiated, and in that case assessment work should be done on each claim.

14. My answer to paragraph 14 would naturally be analogous to that of paragraph 12, as it should make no difference whether the assessment work be done before or after it becomes due.

15. It should be provided that in performing assessment work the equivalent of a given cubical excavation must be made per claim annually as exists today, but that a standard be established regarding the kind of rock excavated. In other words, I have seen dozens of annual assessment workings on as many lode claims consisting of nothing more than the removal of the required 240 cu.ft., but in soft earth or gravel or even decomposed lime or other soft rocks, all easily excavated in a few hours by one man; and seldom is this done for any other purpose than simply to comply with the law regarding annual assessment work. This paragraph particularly should apply to the man or prospector who does his own assessment work, but it should be required that he must record a sworn statement of what work was done.

16. Those who give contracts for their work should be required to file annually a record, sworn to by the contractor, of his assessment work, accompanied by vouchers. It should also be required that assessment work done per claim annually must consist of at least — cubic feet of solid rock excavating. This amount should be determined by arbitrators, separately in each case, in case of litigation. The blank for cubic feet excavation, as far as the law is concerned, is a question on which much can be said before determining it.

It would no doubt be a difficult matter to discriminate between the classes of claim holder and therefore paragraphs 16 and 15 should be brought under the same paragraph. The claim holder should in all cases have the option of doing the work as and when due, or in advance, or as outlined in paragraph 12.

The laws are decidedly too lax in connection with this point, and the State should enforce the point more rigidly. Many claim holders who have 20 to 30 claims, whether adjoining or not, seldom spend anywhere near the required amount of money annually (especially if the properties are not being operated). This is my reason for wishing to see the law require a sworn statement, with vouchers, to be filed.

This brings up another point—that of the validity of a sworn statement made by the contractor who does the work. The claim holder in this case should not be held liable if the contractor's sworn statement be false.

STUART OTTO.

1876 Broadway, New York City, Sept. 1, 1916.

Determination of Copper in Low-Grade Ores

I think the article on "Determination of Copper in Low-Grade Ores," by F. O. Hawley, published in the *Journal* of Aug. 12, is of extreme interest to chemists who have to deal with low-grade, impure ores and slags that carry impurities interfering with the ordinary electrolytic assay. At the best, the straight electrolyzing of the acid solution of a slag after treatment with HF and H_2SO_4 is an unsatisfactory estimation. On some slags good results are obtainable—that is, within three or four hundredths of the correct copper content—but on a works treating custom ores one never knows when one is going to encounter dirty ores. A slag carrying 40% SiO_2 with 5 to 7% CaO and 8 to 10% Al_2O_3 will give 40% FeO (= 31% Fe) and can be run in acid solution with rotating anodes without any difficulty. This is not so, however, when a slag like the following is on hand: 62.1% FeO = 48.4% Fe and 34% SiO_2. Such a slag I have seen produced in a blast furnace concentrating low-grade matte where no lime was used in the smelting. On such a slag straight acid-electrolytic determination is unsatisfactory, especially in view of the time limit usually given for getting out results.

Mr. Hawley quotes examples on a heavy sulphide ore. I think there must have been an error in the statement that the ore contained about 60% pyrite; I believe it should be 90% pyrite. Some months ago I was with Mr. Hawley at the International Smeltery at Miami, and

this method was in use on ores of following composition: Fe, 42%; S, 48%; Cu, 3%; with 5% SiO_2 and Al_2O_3. I have found the method of advantage on many such ores as those in the following two examples:

Ore A			
Electrolytic assay in acid solutions using rotating anodes	7.37	7.37	7.42
Electrolytic assay in acid solution using stationary anodes	7.20	7.26	
Hawley alkaline method	6.99	7.00	
Permanganate assay	6.96	6.98	
Ore B			
Electrolytic assay in acid solution	8.11	8.12	8.34
Hawley alkaline method	7.92	7.92	
Permanganate assay	7.90	7.92	

The impurity in ore A was arsenic, and in ore B was bismuth.

On first reading the method, one might be led to the conclusion that the time factor was all against it, but it will be found that this is not so. The result can be out within 1¾ hr. of weighing the sample, or rather the set of samples. If six or 8 slags are decomposed in either platinum or porcelain dishes by means of HNO_3, HF and H_2SO_4, evaporated to strong fumes, cooled, taken up with water and the requisite acid added, then estimated at a low amperage to get coppers as clean as possible, it will not be done in any less time than by the alkaline method given and there will not be the same accuracy in all cases.

HARRY A. B. MOTHERWELL.

Clifton, Ariz., Aug. 21, 1916.

Increased Cost of Explosives

One hears an increasing number of complaints these days from mine leasers concerning the great and increasing cost of explosives and other mine supplies. It seems pretty well established locally that the prices of most supplies have risen at least 100% in the last two years. I have no data, but would be glad to see the *Journal* publish anything illuminating the subject. I presume the Joplin district is not the only one in which the pinch of high prices is felt.

LEASER.

Joplin, Mo., Aug. 10, 1916.

[From the number of inquiries of similar nature received, it is evident that the Joplin district has not been singled out for trouble over high prices. From Alabama to Alaska the story is practically the same—high prices everywhere and fear of still further advances.

It is a peculiar coincidence, some correspondents evidently think, that prices of supplies should have risen so rapidly just as the miner seemingly had the chance of a lifetime to make material profits as the result of high prices received for mine products. As a matter of fact, hints at a general conspiracy to raise prices are foolish, as even a cursory examination of the situation will show.

The following is fragmentary data readily available without research into all prices up to date. First, as regards steel supplies for the mine, such as drill steel, rails, track supplies, etc., it is probable that an average advance in all districts of from 30 to 40% prevails at present over prices of about Aug. 1, 1914.

Mill-supply steel of common grades, such as shoes and dies, is included in the same price range, but for pipe and pipe fittings the increase is apparently from 60 to 75%. Prices for special grades of steel have of course gone out of sight owing to war conditions needless to detail. Tool steel, for instance, has advanced over 500%.

For explosives the price increase in the East and Middle West has been from 66 to 75% for 40% dynamite and from 90 to 92% for 50%. Detonating caps have advanced from 91 to 100% and ordinary grades of fuse about 40%. We presume the increases in the West and other sections have been about the same, but have no data available. With our American manufacturers rushed with European war orders for explosives and forced to pay greatly increased prices for their raw materials, the situation is obvious.—Editor.]

Belt and Bucket Elevators

The article by Arthur O. Gates in the *Journal* of July 1, 1916, is a timely and, in the main, practical discussion of that much-neglected and much-abused mechanism, the bucket elevator. In the matter of the proper speed at which an elevator should be run, however, Mr. Gates' theoretical discussion leads only to a general rule that he has embodied in the chart, and that in no sense gives sufficiently accurate results for the designer.

Materials of different sizes, different percentages of moisture and different physical properties require different speeds in order to properly discharge the buckets over the head pulley, and because of this it is difficult to see how a chart can be constructed to cover in a satisfactory manner the speed range necessary for even the most commonly handled materials, in relation to the size of the head pulley.

I have for several years used a formula in which the coefficient is easily determined and which is based on the simple assumption that the same centrifugal force is required to give a satisfactory discharge in all similarly constructed elevators handling similar material. Let

R_1 = Radius in feet of head pulley on elevator No. 1 (measured to center of gravity of cups);

R_2 = Radius in feet of head pulley on elevator No. 2;

V_1 = Necessary speed in feet per minute of elevator No. 1;

V_2 = Necessary speed in feet per minute of elevator No. 2.

Then from the familiar formula for centrifugal force,

$$F_1 = \frac{W\left(\frac{V_1}{60}\right)^2}{gR_1} \qquad F_2 = \frac{W\left(\frac{V_2}{60}\right)^2}{gR_2}$$

and from the foregoing assumption,

$$F_1 = F_2, \text{ or } V_2 = \left(\frac{V_1}{\sqrt{R_1}}\right)\sqrt{R_2}$$

The term $\left(\frac{V_1}{\sqrt{R_1}}\right)$ may be taken from an existing elevator and may be used in the formula for all other elevators as assumed. In my notes are values for this term ranging from 241 for chain elevators handling damp slack or ashes to 386 for belt-and-bucket elevators handling dry crushed quartz ⅛ in. and under. Any engineer can easily compile a table of the constants needed in his practice. Of course Mr. Gates' analysis points the way to improved practice and should be studied by all having to do with elevators.

I am not sure that this method of solving the problem of the proper speed of bucket elevators in practice is original with me, but I do not recall having seen it in print and I simply present it for what it may be worth.

THOMAS A. STROUP.

Salt Lake City, Aug. 21, 1916.

The Sterling Iron Mines*

One of the earliest iron-mining operations in the United States was at the Sterling mine, in Rockland County, New York, between Tuxedo and Greenwood Lake. This mine was opened in 1745 by the "Sterling Iron Works," William and Abel Noble, and later, Noble, Townsend & Co., being the proprietors. The mine is of historic interest, being the source of iron used in making the chain that was stretched across the Hudson River, near West Point, to prevent the passage of the British fleet during the Revolutionary War. The mine is still in operation under the ownership of the Sterling Iron and Railway Co.

In 1776 Washington saw three British ships of war pass up the Hudson without suffering any interruption from the obstructions that had been placed across the river, nor from the fire of Fort Washington and Fort Lee. All he could do was to send warning to General Clinton, in the Highlands, and the other American forces farther up the river, to be ready. In October, 1777, the iron chain that had been stretched across the river between Fort Montgomery and Anthony's Nose was broken by the British ships, the enemy captured Fort Montgomery and Fort Clinton and sailed on up the river to burn the town of Kingston. A second barrier had failed to stop the enemy, and it was too late to save the river towns.

When the defeat of Burgoyne at Saratoga prevented the union of the two British forces—Burgoyne from Canada, and Sir Henry Clinton, who had ascended the river as far as Kingston, but was obliged by Burgoyne's defeat to return to New York—one more chance remained to keep the British out of the Hudson Valley, which was the master key to the colonies. To make safe this final chance, Washington made it clear that no effort must be spared. He wrote to General Putman: "I request you, in the most urgent terms, to turn your whole force and all the means in your power for erecting and completing, as far as it shall be possible, such works and obstructions as may be necessary to defend and secure the river against any future attempts of the enemy. You will consult Governor Clinton, General Parsons and the defense engineer, General Radière, upon the occasion. By gaining the passage you know the enemy have already laid waste and destroyed all the houses, mills and towns accessible to them. Unless proper measures are taken to prevent them, they will renew their ravages in the spring or as soon as the season will admit, and perhaps Albany, the only town in the state of any importance remaining in our hands, may undergo a like fate and a general havoc and devastation take place. To prevent these evils, therefore, I shall expect that you will exert every nerve and employ your whole force, in future, while and whenever it is practicable, in constructing and forwarding the proper works and means of defense."

To carry out these instructions no halfway measures were possible, and after a conference and discussion with Robert R. Livingston and several others of the most highly qualified men, it was decided that West Point, where the Hudson makes a double turn, should be chosen as the place for the obstructions and fortifications.

This being determined upon, it remained for a means of obstruction to be found that would be sure. At the direction of Washington the matter was taken up by Peter Townsend, proprietor of the Sterling Iron Works, who held the opinion that an iron chain could be made strong enough to prevent any ship from passing up the river. Accordingly, the iron for this chain was mined from the Sterling mine, smelted at the Sterling furnace, wrought at the Sterling forge into bars varying from 2½ to 3½ in. square, and finally was welded there into links about 2 ft. long. The workmen engaged were exempt from military service. The chain was 500 yd. long and weighed 186 tons. It was of course too heavy to be taken to the river whole, so it was carried over the mountains two or three links at a time, on ox-carts and on muleback. Forges at the river welded the links together. The chain, supported on logs at just the proper distance below the surface and anchored firmly with anchors of Sterling iron, was placed between West Point and Constitution Island on Apr. 30, 1778. It did its work well, and no British ships gained access to the upper Hudson by breaking or evading it. When it was removed in 1783, after the declaration of peace, it was unbroken, and the links are still to be seen at West Point, at the

A SKIP DUMPING AT THE MINE BIN

THE ENTRANCE TO THE STERLING MINE

*Excerpt of an article by J. W. Ritchings, Jr., in "The Telephone Review," July, 1916.

home of Mr. Coxe at Southfield, and at various other places in New York State. The mine that supplied the great West Point-Constitution Island chain is in operation to this day.

The Sterling Iron and Railway Co., operates the branch railroad from Sterlington, N. Y., on the main line of the Erie Railroad, to the mine, and it traverses a section of Rockland and Orange Counties for a distance of about 7 mi., passing en route Sterling furnace, erected in 1848 at Sterling Pond. The ruins of this furnace are still to be seen near the highway, about midway between the Sterlington railroad depot and the Sterling mine.

The old Sterling furnace, where the chain was forged, was erected in 1751 by William and Abel Noble, and its ruins may be seen today at the south end of Sterling Lake. Here the Daughters of the American Revolution have placed a tablet in commemoration of the furnace and the making of the chain.

The possibilities of productive iron mining on this site were first adjusted in about 1735, when Cornelius Board, in the employ of a London company, while prospecting for gold and other valuable metals in what was then known as "Northern New Jersey," came upon iron ore in great quantity and of a very high grade, at what is now the Sterling mine. About ten years later, 1745, a company was organized as the Sterling Iron Works.

In those early days, dynamite, caps, fuses and drills were unknown and a primitive method of mining was in vogue. Black powder was placed on the spot that was to be blown up, a long straw was lighted, and the unlighted end was placed over the powder. In due time the powder would become ignited, and part of the time, at least, the desired result was obtained.

The mine shaft, sloping at an angle of 18°, descends 3,000 ft. and has a vertical depth of 500 ft. under the center of Sterling Lake. Two shifts of about 90 men each, with improved electrical equipment, handle about 500 tons of ore per day. The ore and rock is brought to the crusher and sorting house by means of skips and conveyors, where it is sorted and the ore deposited in large cars ready for shipment. Practically the same number of miners is employed today as 50 years ago, but because of the introduction of modern machinery and electricity, the annual production has been increased from 2,000 to over 100,000 tons of ore.

Until recently steam pumps, steam hoists, etc., were in use, but today they are replaced by modern electrical equipment. Electrical power is furnished by the Harriman power plant, at Harriman, N. Y., and is brought to the mine across the mountains, a distance of 10 mi. The ore is made into iron which is used for foundry iron, for making anchors, chains, nails, etc., and is put to practically the same uses that it was in the early days.

A SECTION OF THE ORIGINAL CHAIN THAT WAS STRETCHED ACROSS THE HUDSON RIVER AT WEST POINT
The chain is now on the lawn of the Hewett Homestead, Ringwood, N. J.

Marigold All-Steel Dredge

Marigold No. 5 dredge began digging in the Yuba Basin field, Yuba County, California, on May 7, 1916. Active construction was begun Dec. 26, 1915. This is the first all-steel dredge installed by the Marysville Dredging Co. It is equipped with 86 California type buckets of 16-cu.ft. capacity and designed to dig 68 ft. below the water line, handling over 10,000 cu.yd. of material in 24 hr. The drawings, machinery and material were furnished by Union Iron Works, of San Francisco. The dredge was constructed by the Marysville Dredging Co., which maintains shops at Marigold. T. D. Harris is manager of the company. The design and construction were patterned after Yuba No. 14, built by the Yuba Construction Co., but with special changes and improvements.

The hull is 155 ft. 6 in. long, 58 ft. beam and 5 ft. overhang on each side, 11 ft. 6 in. deep. The well-hole is 8 ft. 3½ in. wide in the clear; the bow end of well-hole pontoons 24 ft. 8¼ in. wide. The hull is painted inside and outside with bitumastic enamel.

The digging ladder is 132 ft. long from center to center of the tumbler, built in four sections, the heaviest section weighing 70,100 lb.; total weight 250,000 lb. The ladder complete, with rollers, weighs 300,000 lb. The buckets each weigh 4,200 lb. plus 425 lb., weight of the pins. The total weight of the bucket line is 398,000 lb.

The lower end of the digging ladder is covered with heavy wearing plates on the under side. The upper tumbler is six-sided, weighs approximately 20,000 lb. and has 42-in. pitch; the lower tumbler is round and weighs approximately 26,000 lb., cast in one piece. Both tumblers are of manganese steel.

The bow gantry is constructed of 30-in. I-beams. The bow deck is covered with checkered plates. The bucket idler is cast in one piece, lined with manganese wearing plates.

The tailing stacker, without idlers or belt, weighs 46,000 lb. The conveyor belt is 145 ft. long, center to center of drums, and 42 in. wide. The stacker-ladder deck slopes down each side from the center at 45° angle, and a wellway through the hull at the foot of the stacker catches the spill off the belt.

The revolving screen is 50 ft. long and 9 ft. inside diameter. The longitudinal bars on the screen are flat instead of angle iron. The screen is equipped with twenty-six 2-in. nozzles fitted to the spray pipe with saddles in such manner that they can be adjusted at any angle, the pipe extending through the length of the screen. The spuds are 62 ft. long, 60 in. wide and weigh 82,000 lb. each. The digging spud is made of four Bethlehem steel I-beams, bolted together instead of riveted.

The main drive has all cut gears. The first set are of herringbone type; the master gears are 14 ft. in diameter with 14-in. face split through the center. The main drive and ladder-hoist motor is of 400 hp.; the swing winch motor, 50 hp.; stacker motor, 60 hp.; screen motor, 75 hp. Screen and stacker motors drive through chain belts. The swing drums are 30 in. in diameter and are placed at the head of the main winch so that the remainder of the winch can be cut out by a clutch when not in use.

The pumps are Yuba Construction Co. type, made by that company. There are one high-pressure 14-in. 150-hp. pump and one low-pressure 14-in. 75-hp. pump; one 6-in. 2-stage priming pump, 50 hp.; one 8-in. bilge pump, 10 hp.

The housing is constructed of 4-in. channels, two sheets of light iron with asbestos filler between; the roof is galvanized iron sagged between deck channels with 1¼-in. decking.

Chronology of Mining for August, 1916

August 1—United Verde Extension paid initial dividend.

August 3—Strike of asbestos miners in Thetford Mines, Quebec.

August 10—South Hecla Mining Co. paid initial dividend.

August 12—Walker Mining Co.'s property in Plumas County, California, passed to International Smelting Co.

August 14—Rosiclare, Ill., fluorspar mines resumed after idleness of one month, due to strike.

August 15—Utah Metal and Tunnel Co. paid initial dividend.

August 16—First coal train from Matanuska coalfield, Alaska, over Government railway, left Goose Creek for port of Anchorage.

August 24—Calumet & Hecla increased its dividend to $20 per share.—Centennial Mining Co. declared initial dividend.

August 30—Ohio Copper Mining Co. sold for $750,000 to E. H. Sykes, of Sullivan & Cromwell, New York, representing the bondholders.

The Promontory District, Utah*

The Promontory district is in Boxelder County, Utah, near the south end of the range that forms a long promontory on the north shore of Great Salt Lake. The area in which ore has been produced is 3 to 4 mi. north of the Southern Pacific cutoff and at an elevation about 1,000 to 1,500 ft. higher. The connecting wagon road has a gradual grade in favor of the load for most of the distance, but is rather steep near the camp. Wagons and motor trucks were used in hauling ore to the railroad and supplies to the camp. The range supports a rather scanty growth of cedar and other scrubby trees which are available as a fuel supply. There are some springs on the south end of the promontory, but none near the camp. Water was brought in on the railroad for the section crew at Saline and the Lake View mining camp. An attempt will doubtless soon be made to develop a near-by supply of water. The camp of the Lake View Mining Co., owners of the only producing claim in the district, is on a bench of Lake Bonnerville, the predecessor of the present Great Salt Lake.

Lithologically Similar to Tintic

According to Hague, the basal formation of the range is made up of Archæn schists. This formation is overlain by a great series of quartzites whose thickness has not been determined, but is several thousand feet. The quartzite series is believed to be the equivalent of the Cambrian and Algonkian quartzites and shales in the Wasatch Range, which vary in thickness but in big Cottonwood Cañon exceed 10,000 ft. Above the quartzite comes a succession of shales, impure limestones and sandstones, with some beds of rather pure limestone toward the top of the series. This group attains a thickness of 700 to 800 ft. Above this series there are heavy bedded limestones which attain a thickness of several thousand feet.

Lithologically and paleontologically the rocks between the quartzite and the upper limestone series closely resemble the series of shale and limestone occurring at a similar horizon at the Wasatch, Oquirrh, Tintic and other ranges, though both the shales and the limestones are more abundant in the promontory mountains than in any of the other ranges mentioned. Limestone is, however, even more abundant at this horizon in northeastern Utah.

The upper part of the quartzite series is doubtless of Cambrian age, and the lower part may be Algonkian, though this has not been determined. The limestone and shale series overlying the quartzite is of Cambrian age. The age of the upper limestone probably ranges from Cambrian to Carboniferous.

No igneous rocks were observed in the vicinity of the mineralized area. Samuel S. Arentz states that a dike

*Excerpt from Bulletin 640-A of the United States Geological Survey.

4 ft. in width and traceable for about 150 ft. cuts the heavy bedded limestone east of the Lake View property. In the hand specimen this is a dark green rock apparently having the composition of a rather basic diorite, or possibly diabase. Similar rocks are said to cut the quartzite west of the Lake View property.

The general structure of the range at the south end is monoclinal. The beds strike about N 40° W and dip 30 to 40° N. This apparent monocline may be the eastern limb of an anticline from which the western portion has been removed by erosion. Some indication that such is the case is given by a small area of westward-dipping sediments near the south end of the promontory. Minor faulting in northerly and easterly directions has taken place, but so far as observed the displacement is at most but a few feet. Prospecting in the range until recently had been largely confined to two localities, both near the southwest side of the promontory. For several years there has been some prospecting of copper deposits in the quartzite series on the west side of the promontory about 1½ mi. northwest of Saline. In 1907, 14 tons of hand-sorted ore, averaging 3.85% of copper and 1 oz. silver to the ton, were shipped. The present activity is confined largely to the zinc-lead deposits. In December, 1914, workmen doing some assessment work on a placer property walked up the wash to the limestone beds outcropping above. Boulders of lead-zinc carbonate were discovered in the talus and traced to the outcrop of ore in place found at the top of the 100-ft. bed of limestone, forming the so-called middle bed in contact with shale. Locations were then made, and a few holes were dug on the outcrop. After an examination made in February, 1915, by Samuel S. Arentz, of Salt Lake, a fifth interest was negotiated for and obtained in March. Mr. Arentz began operations as one-fifth owner and under contract to manage the mine for one year. The net weight of ore shipped to Aug. 1, 1915, was 1,961,900 lb., averaging as follows:

ORE FROM THE LAKE VIEW MINE

	%		%
Lead	7.7	Zinc	32.75
Iron	1.1	Sulphur	0.2
Silver	0.2	Moisture	1.9
Gold	Trace	Insoluble	16.0

The gross returns for 21 cars were $35,636.75. The company reported that it had paid dividends of $8,119.75 to Aug. 1 and had a balance of $7,180.14.

Zinc More Abundant Than Lead

Prospecting of zinc and lead deposits has been confined almost entirely to the middle limestone bed. This is 50 to 75 ft. thick, included in members composed prevailingly of shale. The ores have been formed by replacement of this limestone near the north-south fissures. The largest deposit thus far disclosed occurred just beneath the overlying shale, though development has shown that considerable mineralization has taken place at lower horizons in the ore-bearing limestone. Present developments show that zinc is far more abundant than lead.

Prospecting has been carried on along the outcrop of the middle bed for a distance of about 4,500 ft., and bodies of ore are shown in numerous openings. In the development of the property the managers seem to have followed the conservative policy of determining the amount and character of the mineralization along the outcrop before beginning extensive developments at depth, and at the time of visit the ore zone had nowhere been exposed more than a few feet below the surface. Sufficient data concerning the mineralization had been obtained, however, to warrant the planning of deeper development work. The region is one of considerable relief and suited to the development of the ore bed for several hundred feet below its highest outcrop by means of tunnels. Practically no work has been done on the lower limestone, though it is said to contain as much as 3½% of zinc on the outcrop.

Copper Deposits in Prospect Stage

The copper prospects of the Promontory district are about 1½ mi. northwest of Saline station. The deposits crop out on the crest of a ridge near the shore of the lake. The country rock is the quartzite near the base of the exposed sedimentary rocks of the south end of the range. The beds at this point strike N 45°-50° E and dip 16°-20° SE. The ore is disseminated in the quartzite. The primary mineralization formed chalcopyrite and possibly bornite, but at the surface the sulphides have been altered to carbonates.

The developments consist of two shafts about 200 yd. apart, sunk from the crest of the ridge, one having a depth of about 50 ft., the other 120 ft. At a lower point an inclined shaft was sunk on a westerly pitch nearly at right angles to the dip of the beds to a depth of 80 ft. Near the same point a tunnel has been driven eastward for about 100 ft. At a point near the shore of Great Salt Lake and about 200 ft. vertically below this tunnel another tunnel has been driven eastward for 452 ft. This was projected to intersect the downward extension of the ledge that outcrops on the ridge.

Some mineralized rock was observed in the prospect openings, and it is said that more valuable ore was encountered at some points which were not accessible when the investigation was made. The ore shipped was obtained from large blocks of mineralized quartzite at the surface.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUNITE—Treatment of Alunite and the Like. Howard F. Chappell, New York, N. Y., assignor to Mineral Products Corporation, New York, N. Y. (U. S. No. 1,195,655; Aug. 22, 1916.)

CARNOTITE—Process of Concentrating Carnotite Sandstone Herbert N. McCoy, Chicago, Ill. (U. S. No. 1,195,698; Aug. 22, 1916.)

CLASSIFIER—Ore Classifier. William Henry Weigand, Trojan, S. D. (U. S. No. 1,192,806; July 25, 1916.)

COBALT OXIDES—Electrolytic Process for the Extraction of Cobalt Oxides. Kenneth S. Guiterman, New York, N. Y. (U. S. No. 1,195,211; Aug. 22, 1916.)

CONCENTRATION—Ore Concentrator. William Fagergren, Salt Lake City, Utah, and William D. Green, Butte, Mont., assignors, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,195,453; Aug. 22, 1916.)

COPPER PRECIPITATION—Method of Making Acid and Insoluble Metallic Compounds. George D. Van Arsdale, New York, N. Y. U. S. No. 1,195,421; Aug. 22, 1916.)

CRUSHER—Swinging Ore Mill. Jacob Lampert, Rapid City, S. D. (U. S. No. 1,192,535; July 25, 1916.)

ELECTRIC-ARC FURNACE. Emil Edwin, Christiana, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiana, Norway. (U. S. No. 1,193,882; Aug. 8, 1916.)

ELECTROLYSIS—Method of Preventing Disintegration of Anodes. George D. Van Arsdale, New York, N. Y. (U. S. No. 1,193,741; Aug. 8, 1916.)

FURNACE. Utley Wedge, Ardmore, Penn., assignor to the Furnace Patent Co., Philadelphia, Penn. (U. S. No. 1,195,424; Aug. 22, 1916.)

VOLATILIZING—Process of Volatilizing Metals. Selden Irwin Clawson, Salt Lake City, Utah. (U. S. No. 1,192,037; July 25, 1916.)

Editorials

How the Railway Strike Was Averted

The threatened railway strike was averted on Sept 2 by Congress giving the labor leaders everything they wanted, although it was not the right of Congress to give, and the railway stockholders will have to pay. It was easy for Congress representing the people to give away what did not belong either to it or to the people.

The President, having found himself in an awkward predicament, appealed to Congress, asking it to enact a series of half-baked expedients in the closing days of the session. Congress, as was to be expected, discarded everything but what it knew would satisfy the labor leaders; namely, the enactment of a law requiring present rates of wages enjoyed by certain employees engaged in interstate commerce to be figured on the basis of an eight-hour day.

This bill was promptly passed in the House of Representatives. The Senate received it on Sept. 2 and had to enact it before sunset. All day long the labor leaders sat in the galleries watching the reverend senators, squirming in their consciousness of the injustice and indignity of the thing, vote an increase of wages to fewer than one per cent. of the population of the United States to protect the rest of the citizens and their families.

This action of Congress was probably illegal. Certainly it will be tested in the Courts. But before the Courts can render decision, the law will have been put into effect and the aristocrats of railway labor will have obtained their increases; and no matter how the Courts may decide, wages cannot be reduced, for it is now the accepted principle that wages may be advanced but never may be reduced. The President and Congress knew that on Sept. 1 and 2 they were doing a monstrous thing out of motives of political expediency. They committed a greater wrong than perhaps they know. They cowardly surrendered a great principle and dealt a blow to our republican form of government. No longer are we a free people. We know now that there is an empire within the republic—a power to which the mass of the people must defer. We rose against George III, but we cringe before Samuel Gompers. A week ago this would have seemed incredible. Today we stand aghast at the reality. If the railway labor leaders should decree that every non-union man of voting age must wear a pink necktie, there would be nothing to be done but obey.

Nothing to be done until we get some leaders who will stand firmly in another Lexington and fire a shot that will be heard from ocean to ocean. The time will come when the mass of the people, with brave leaders, will assert themselves.

In the meanwhile the laws of economics, which are as immutable as that of the conservation of energy, will operate silently but surely. If the railways of the United States are to be dominated by predatory politicians and eaten up by unionized labor, investors will not subscribe to their stocks and bonds and the extensions of railway facilities that are needed as the population increases will not be made. Even in an oligarchy people cannot be compelled to invest in what they do not want to.

The crime against democracy that was committed on Sept. 1 and 2 may be appalling in its consequences. In order to save the public some temporary inconvenience, the representatives of the people sold their birthright. What American, save the small percentage who by terrorizing imposed their will, can feel anything but shame today? We live now in a state of terror of a supreme power within our nation. New York City is already threatened with another and general railway strike. Next it may be the anthracite mine workers who will tell us to go cold this winter unless they be granted all they want. And so on. Let the people rise in self-defense!

Revision of the Mining Laws

The most effective argument against abolishing the present prerequisite of discovery has been made by E. D. Gardner, of Montana, in an address delivered originally before the Montana Society of Engineers and republished in the bulletins of the Mining and Metallurgical Society of America and of the American Institute of Mining Engineers. Mr. Gardner points out that the abolition of this requirement will open the door to serious abuses in the acquirement of mineral land for other than mining purposes. He illustrates these by a variety of accounts of what has happened and suggestions of what might happen. Most of his illustrations are pertinent.

It is freely to be recognized that conditions in Mexico, where discovery is not required, and in the United States are different. In Mexico the government does not part with its ownership, but confers mining rights only so long as certain conditions, including the payment of taxes, are fulfilled. The taxes are a great deterrent to anybody locating claims simply to hold them for unearned increment.

In the United States the system has been designed to grant mineral lands in fee simple, and there has been no general demand for a departure from that system. Any ideas of change in this respect would doubtless be unpopular. The United States permits claims to be located and held, however, only upon condition that work to a certain amount is done annually upon them. This is equivalent to a tax, but instead of its being paid into the Federal treasury, it is supposed to be spent in the development of the property. That often it is not so spent is one of the evils of our present mining laws. An amended law should provide for the honest performance of assessment work and means for seeing that it is done. If the law be properly drafted in this regard, there will not be much locating and holding of claims for unearned increment, nuisance value, etc.

The strongest point against Mr. Gardner's arguments is that under our existing laws the discovery prerequisite is abolished by common consent. Many claims have been located during the last 40 years upon nothing but an al-

leged discovery, which everybody knows to be no true discovery, but nobody protests for the reason that some day he may want to do the same thing. Many claims have been held and patented without the $100 worth of annual assessment work ever being done upon them. The present laws encourage initial perjury and a repetition of perjury annually until patent is obtained, and the perjurer may rest in peace, awaiting a purchaser for his claim or for some neighbor to discover an orebody leading into it.

The arguments in favor of the abolition of the requirement of discovery are the removal of those evils and the simplification of the system. Mineral lands of all kinds—metallic, oil-bearing, stone quarries, salines—except, perhaps, coal ought to be locatable by one kind of claim and under one set of conditions. Abolishing the discovery prerequisite, moreover, renders unnecessary special provisions for locating mill sites and tunnel sites. The man who wants to drive a tunnel may simply locate a string of claims on its course.

Alaska Gold Mines Co.

On Aug. 31, after the price of Alaska Gold Mines Co.'s shares had been slumping for several days, Charles Hayden, president of the company, made a statement which cleared up the uncertainty about the affairs of this company that has been disturbing its stockholders during the last year, within which time the shares have declined from about $40 to about $12. The reason for this decline was the series of bad monthly reports, showing that the ore was assaying only about $1.17 per ton instead of the $1.75 that was expected. The explanations of Mr. Hayden and Mr. Jackling respecting this were that ore was being taken from lean parts of the mine, that the mine had not been sufficiently developed to furnish the immense tonnage of average grade that was planned, that the mine workings would soon be in the better ore and the monthly averages would increase. Mr. Jackling has reiterated repeatedly assurances that conditions and prospects were just as he had affirmed in his annual reports. We fear that neither Mr. Hayden nor Mr. Jackling have been quite frank in their statements about the developments in this property since its big mill was put in operation. The most generous interpretation of their attitude is that, while they may have had misgivings, they could not feel sure that their fears were correct and hoped that they were not.

In his last statement, wherein he frankly confesses disappointment, Mr. Hayden offers a rather confused explanation and, owing to his lack of clarity, lets a worse impression be formed than probably he intended or ought to be. He gives the idea of saying, "Well, we've had a good run for our money and we'd do the same thing again," which is not at all what he meant to say, we fancy. What he meant to say, or might have said, is: "We have misunderstood our mine and have got to alter our method of mining, which is going to result in some delay and some loss of work that has already been done in opening the mine."

Readers of the *Journal* will remember our previous remarks respecting the difference of opinion between the Alaska Juneau and Alaska Gastineau (Alaska Gold Mines Co.) managements with regard to the mining of the Juneau lode and the ways in which they were going about it. The Juneau lode (which we thus refer to for convenience rather than for accuracy) is not uniformly mineralized, but contains portions that are payable interspersed with portions that are barren. The payable portions are of such immense size that they are capable of mining by the most economical methods. Mr. Bradley, who was the pioneer in the district and acquired for the Alaska Juneau company what was regarded as the best part of the lode, had always a clear perception of this and laid out his mine for what may be called selective bulk mining, designing to leave the barren portions of the lode unmoved and obtaining a relatively fair grade of ore by selection. Mr. Jackling came into the district later and, inspired by the idea of doing things on the hugest scale, determined to remove the whole lode, from wall to wall. Even so he thought it would average $1.75 per ton. However, in the mining of about 1,200,000 tons this year, the average has been only $1.17 per ton. Apparently it is now recognized that a mistake was made and that it is necessary to shift to the Alaska Juneau system of mining. This, however, is going to take some time, and in the meanwhile a large quantity of ore already broken and lying in the stopes of the old system must be run through the mill.

As to the loss to the Alaska Gold Mines Co., this is chiefly the loss of time in bringing the enterprise to the profitable stage and the expense of breaking some 3,000,000 tons of ore that is not going to yield what was expected. When plans are revised, the company probably hopes to be able to mine ore of the grade reckoned and make the expected profit from it. The mine will not be found to have so much gold ore in it as was estimated, but the tonnage is probably so great that this will make no great difference in the calculations. Instead of there being 75,000,000 tons averaging $1.75, there may be that amount averaging about $1.20, or about 50,000,000 tons averaging $1.75. We do not know respecting the latter figures but suggest them merely as being illustrative.

Alaska Gastineau is a disappointment to its promoters and managers in the sense that they have found that they cannot break down all the ore from wall to wall—a width of hundreds of feet—and mill it at so much profit as they estimated; and it is a disappointment in the sense that they have found themselves mistaken in thinking that they could do so. This, however, is far from pronouncing the enterprise a failure—an enterprise in which about $10,500,000 has been expended, including about $3,000,000 for the purchase of the property. Its mining experience is simply what the Alaska Juneau engineers have been foreseeing.

American Investments in Russia

Not only are American bankers and manufacturers becoming interested in Russia, but also are American mining syndicates turning their eyes thither. Investigations of the mineral resources of the Siberian part of Russia are already being undertaken by some of the most important of American mining concerns.

Without any doubt, one of the results of the present world-wide upheaval is going to be a great extension of American interests abroad. In South America, American exploitation will be more important than ever. A great American enterprise in the development of gold mines in the Witwatersrand of South Africa has been under consideration. But more than anywhere, we

anticipate, will there be American interests in Russia—a great undeveloped country which in all likelihood will emerge from the great war in a condition somewhat similar to what there was in the United States at the termination of the Civil War.

BY THE WAY

In commenting on the Bowena Copper Co. one of our leading financial papers remarks: "We are willing to become as enthusiastic as the projectors when the Bowena people dig tunnels, shafts, bunkers and concentrators." There is a well known saying about the blind leading the blind.

⁂

Just before the Clifton-Morenci strike was called, a mucker went to his foreman at one of the copper properties in that district and said he would like to quit and desired "his time." The foreman looked at him with that "grouch" which is characteristic of all foremen, and said, "All right, but I knew you would not stay when I put you to work." The mucker had only been on that job 24 years and 7 months.

⁂

The Boston *News Bureau* in attempting to answer "a general call for a clear statement of the lesson from Alaska Gold," offers the following: "Gold is never found deposited on the same lines as the lower metals, silver, copper, lead or iron. Gold is elusive and is most often deposited in gyrations or spiral forms not easily followed in large mining operations. Even where deposited in veins or blanket formations, the gold areas in the rock are in chutes not easily discernible except by careful analysis." These ideas will be interesting to mining engineers and geologists.

⁂

An electric haulage system had been newly installed in the mine, and "the boys" were very much loath to accept the new order of things. The common trouble of current leakage had been experienced at first, especially in wet ground, and at the end of a week's work a number of the turbulent Irish miners were in a state of mind ready for anything. Malony had just received another minor shock from a wet tunnel wall and was organizing an expedition of protest to visit the office, when the manager himself appeared on the scene. Everyone talked at once, and the manager at first failed to discover the cause of the row. On finally securing a momentary silence while Malony luridly phrased the complaint, the manager caught the drift of his remarks and explained that the current leakage was already being remedied. Malony then consulted with his supporters and, returning to the manager, dramatically pointed to the glistening new copper trolley wire overhead and declared the verdict: "Begobs the b'ys sez to h—l wit' the job if yez don't paint that wire black."

⁂

The American members of the joint commission to undertake settlement of differences between the United States and Mexico are Franklin K. Lane, Secretary of the Interior; Judge George Gray, of Wilmington, Del.; and Dr. John R. Mott, of New York City. The commission will, it is expected, hold its sessions at a New Jersey coast resort. The time and place of the meeting will be arranged by Secretary Lansing and Eliseo Arredondo, the Mexican Ambassador Designate. Probably the first problem taken up by the joint commission will be the proposed withdrawal of American troops from Mexico. As General Funston has recommended the recall of General Pershing's expedition, this is expected to be agreed to by the American members. Dr. John R. Mott, who is a close friend of President Wilson, is international secretary of the Young Men's Christian Association. He went to London in October, 1914, with the object, it was said, of bringing about peace through religious influence. He has been described as "a one-idea man," the idea being "the evangelization of the world in one generation."

⁂

The doctrines of union labor are exemplified by some recent publications. The railway brotherhoods say: "Give us what we demand, or we will strike and paralyze the industries of the United States." When it was argued that the railway business of the country would not stand what they wanted, the brotherhoods published a statement, saying: "Don't kill the goose that lays the golden egg. Every day or so this old bromide is handed the railroad men. Railroad employees, who demand a workday that will give them some hope of expanding their working days and keep them a year or so longer away from the dead line and the bread line, are admonished 'Not to kill the goose.' We are accused of making a raid on the 'goosery,' and the bosses are warning not to kill off the goose nor even disturb her, for the goose is in a delicate way, and possibilities for excessive wear and tear on the goose-egg factory may mean ill health for the goose and rather than upset the even trend of things we'd better not insist upon another egg right now. This is old stuff; it used to be good stuff, but it is not good stuff any more. We have been feeding this goose until it has become some goose; where it has not been squeezed too much, it is a healthy goose, so there is not much alarm over its general health. It is also a fat goose, and viewing all the phases of the situation, railroad men believe the admonition 'not to kill the goose' means keep on feeding the goose ten hours a day and let the bosses gather the eggs, which may not hold to the high-pressure average if the goose is fed eight hours a day. For the sake of the health of the goose the men will take a chance on dieting the invalid on eight hours high-pressure feed. Anyhow, this goose business ought to be on a fifty-fifty basis so that one side of the house will not be all goose, and the other all 'goosed.'" The I. W. W. people are more advanced than the brotherhoods. They are now creating trouble at Broken Hill, N. S. W. According to the South Australian press these familiar and typical notices of the I. W. W. are posted at the mines there. "Don't scab upon the unemployed by working hard. Slow work means more jobs. More jobs means less unemployed, and less competition means higher wages. Less work—more pay. Slow down! Slow down! Don't be a slave. Be a man and join the I. W. W. How to make your job easier. Get wise to I. W. W. tactics. Don't be a pacemaker. Someone has to be the slowest. Let it be you. Join the one big union. Don't be a boss' man by trying to do more work than the other man. Fast workers die young. Live a long life. Join the Industrial Workers of the World, the Fighting Union."

PERSONALS

A. A. Jones, recently in Chosen, is now in London.

T. C. Hsi, lately in New York, has gone to Shanghai, China.

John Frank, lately at Jacksonville, Ill., has gone to Mayer, Ariz.

Don C. Billick has gone from Basin, Mont., to Alturas, Calif.

C. C. Smith, lately at Anaconda, Mont., is now at Cambridge, Mass.

S. A. Walker has gone to Leadville, Colo., from Rye Valley, Oregon.

A. J. McNab is at Fredericktown, Mo. He was recently in Nevada.

J. H. East, Jr., lately at Mammoth, Calif., is now at Hibbing, Minn.

Edwin W. Kiumph has gone from Houghton, Mich., to Butte, Mont.

August H. Chatin, recently at Butte, Mont., has gone to Walsenburg, Colo.

Malcolm W. Clark is now at Billings, Mont. He was recently in Mexico.

J. A. Reid is now at the O'Brien Mine, Cobalt, Ont. He was recently at Toronto.

P. B. McDonald has left the editorial staff of the "Mining and Scientific Press."

A. E. Drucker has discontinued his practice in London, England, and is now in New York.

R. B. Brinsmade, of St. Louis, spent August in mine examinations in the State of Washington.

Wm. F. Jahn is now at the Tough Oakes Mines, Kirkland Lake, Ont. He was recently in Montana.

W. H. Rule has gone from Cornwall, England, to the Prestea Block A, Ltd., Gold Coast, West Africa.

John Gross, mining engineer, of Denver, Colo., has moved his offices from No. 523 to No. 423 McPhee Building.

Roy S. Bonsit, recently at Low Moor, Va., is now with the United States Metals Refining Co., at East Chicago.

George B. Holderer, recently manager of the Furlough Development Co. in Arizona, is now with the General Chemical Co., 25 Broad St., New York.

W. L. Hayes has been appointed manager of the wire mills of the American Steel and Wire Co. in the Chicago district in place of F. C. Gedge, deceased.

August Mann, manager of the Farrell Works of the American Steel and Wire Co., near Sharon, Penn., has been made manager of the plant of the United States Steel Corporation at Donora.

Thomas M. Skinner, Jr., has resigned as superintendent of Mid Continent Chemical Co., Sand Springs, Okla., to accept the position of assistant manager of Potash Products Co., Alliance, Neb.

W. S. Stothoff has been appointed general superintendent of Wm. Wharton, Jr., & Co., Inc., Easton, Penn., and the Tioga Steel and Iron Co., Philadelphia, in charge of plants and manufacturing.

E. W. Widdowson, provincial chemist and assayer, Nelson, B. C., gives notice that he is still in charge of his office, his application to enlist having been rejected, as he was unable to fill all the requirements.

W. Earl Greenough has resigned as managing director of the Marsh Mines Consolidated, Wallace, Ida., and will take up independent practice as consulting mining engineer, with headquarters at Spokane, Wash.

Ivan P. Tashof has resigned as instructor in mining and metallurgy at the College of Mines and Metallurgy of the University of Kentucky, and purposes to enter the practice of patent law with Byrnes, Townsend & Brickenstein, of Washington.

Hon. Dr. Roche, Canadian Minister of the Interior, has returned to Ottawa from a trip to the Yukon. He reports all the big mining plants busy and the output of gold well maintained. The war has greatly stimulated the copper industry and large shipments of ore are being made to British Columbia smelters.

Dr. Willet G. Miller, of the Ontario Nickel Commission, and **T. F. Sutherland,** chief inspector of mines for Ontario, who have been investigating the nickel industry of New Caledonia, sailed from Sydney, Australia, Aug. 31, on their return voyage. **George T. Holloway,** of London, England, chairman of the Nickel Commission, is expected in Toronto early this month.

OBITUARY

Alexander Fraser, metallurgist at the plant of the Compañia Minera de Augustias, Pozos, Guanajuato, Mexico, was killed on July 31 by revolutionists under Nateras. Fraser had been 20 years in Mexico. He was 48 years of age, and leaves a wife and two children in London.

John Hart Wilson, of Pittsburgh, died at Atlantic City, N. J., Sept. 2. He was for many years in business in Pittsburgh and was a director of the Union National Bank. He was interested in several mining enterprises. He was president of the Hidalgo Silver Mine Co., at Parral, Mexico, and was vice-president of the Parral & Durango Railroad Co. of Mexico. He was a member of many fraternal organizations.

SOCIETIES

American Electrochemical Society—The 30th semi-annual convention of this society, whose membership includes many well known electrochemists, will be held at New York, Sept. 27 to 30, at the time of the Exposition of Chemical Industries.

Society for Electrical Development—Arthur H. Halloran, vice-president and managing editor, "Journal of Electricity, Power and Gas," has been appointed Pacific Coast representative of the society. Mr. Halloran's headquarters will be in the Crossley Building, San Francisco. Mr. Halloran will represent the society in the States of California, Arizona, Nevada, Utah, Idaho, Oregon and Washington.

Iron and Steel Electrical Engineers—Central station power for steel mills, the operation of the Heroult electric furnace, the electric reversing blooming mill and portable electric tools in the iron and steel industry are among the subjects to be discussed at the annual meeting of the Association of Iron and Steel Electrical Engineers, to be held at the Hotel La Salle, Chicago, Sept. 18 to 22, inclusive. Following a business session on Sept. 18, there are to be afternoon and morning technical sessions and plant visitations, and many papers will be read.

Minnesota Joint Engineering Board—The engineers of Minnesota believe that through the coöperation of the various engineering societies that they can be more useful to their communities, and are attempting to bring about closer cooperation through the formation of the Minnesota Joint Engineering Board. The constituent societies represented on the Board are the Northwestern Association of the members of the American Society of Civil Engineers; Minnesota Section of the American Society of Mechanical Engineers; the Minnesota Section of the American Institute of Electrical Engineers; the Minnesota Surveyors' and Engineers' Society; the Engineers' Club of Minneapolis, and the Civil Engineers' Society of St. Paul. It is hoped that through this central organization the activities of the engineers of Minnesota may be more closely correlated and more accomplished for the public welfare. Geo. W. Rathjens, of St. Paul, is the secretary of the Board.

Spokane Mining Men's Club is organizing a four-days' excursion into the Nelson and Slocan districts of British Columbia, and the expedition will probably leave Spokane in a special Pullman train the night of Sept. 29, according to tentative plans that have been outlined by Secretary Frank C. Bailey; the return trip will be made the night of Oct. 2. The program provides for a joint meeting at Nelson of the Spokane and Nelson Mining Men's clubs, and it is hoped that a session of the Canadian Institute of Mining Engineers and the Columbia Section, American Institute of Mining Engineers, can be arranged at the same time, as many of the Spokane and British Columbia mining men are members of all four organizations. The special Spokane train will transport the excursionists to Kootenay Landing, on Kootenay Lake, where a special Canadian Pacific boat will be waiting to take them on to Nelson, and from the latter point special boats and trains will convey the party to the different mines that are to be visited, including those in the Sheep Creek, Ainsworth, Kaslo and Slocan districts.

Colorado Metal Mining Association has decided to continue its committee on legislation, which will carry on negotiations with the smelting companies in the interests of the mine operators and miners of Colorado. At the last meeting of the association the committee submitted the following report: "Resolved that the subject covered by the resolution adopted by the Colorado Metal Mining Association at its last annual meeting, proposing by legislation to place the smelters operating in the State of Colorado under the control of the public utilities commission, contemplates such a radical change, that your committee feels it should be continued and given time and power first to properly present the grievances of the members of the association and the miners of the State of Colorado, to the officers of the smelting companies, and obtain their answers, before your association uses its united strength toward the enactment of any constitutional amendment, or other legislation to this end." The committee on the multiplicity of corporation statements required under state laws, of which George C. Manley is chairman, was continued with power to consult with the Colorado survey committee appointed by Governor Carlson and suggest the enactment of a law by the next legislature which would enable all statements to be made in one report. The committee on taxation was continued and authorized to confer with a committee appointed by the Colorado Tax Commission for the purpose of reaching an agreement upon the proper taxation of ore-producing mines. The committee on revision of the federal mining laws, through its chairman, George E. Collins, reported that the adoption of the bill now before Congress would "leave the mining laws in a far worse condition than at present."

TRADE CATALOGS

Leyner Drill Sharpener. Ingersoll-Rand Co., 11 Broadway, New York. Pp. 24; 6x9 in.; illustrated.

Agitation, Thickening and Filtration Apparatus. H. R. Conklin, Joplin, Mo. Catalog. Pp. 12; 6x9 in. Illustrated.

Eureka Cyaniding-Precipitating Machine. Eureka Agency, 1531 18th St., Denver, Colo. Bulletin. Pp. 8; 6x9 in. Illustrated.

Chemical Balances and Weights, Hydrometers, Etc. L. Oertling, Turnmill St., London, E. C., England. Catalog; pp. 40; 8x10½ in.; illustrated.

Combination Gas and Oil-Burning Equipment for Industrial Heating. Tate, Jones & Co., Pittsburgh, Penn. Circular No. 155; pp. 8; 8½x11 in.; illustrated.

Steam Condensing Plants. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 9024; pp. 32; 6x9 in. This bulletin describes the Beyer barometric type condensers.

Air Compressors. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3033; pp. 28; 6x9 in. Imperial Type "XPV" duplex steam-driven compressors are described in this bulletin.

Electric Locomotives. The Jeffrey Manufacturing Co., Columbus, Ohio. Bulletin No. 115; pp. 4; 6x9 in. This bulletin is devoted especially to electric locomotives for smelting plants.

Electric Portable Tools. Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin E-41; pp. 8; 6x9 in. This illustrates and describes the Duntley electric tools for street and interurban railways.

Electric Hoists. Sprague Electric Works, 527 W. 34th St., New York. Bulletin No. 48906. Pp. 32. 8x10½ in.

This illustrates and describes Type S-1, one-half ton and one-ton hoists.

Portable Conveyors. The Jeffrey Manufacturing Co., 974 North Fourth St., Columbus, Ohio. Bulletin No. 184; pp. 10; 6x9 in. This illustrates and describes conveyors for handling barrels, boxes, packages, bags, etc.

Refractories. Norton Co., Worcester, Mass. Catalog. Pp. 54; 5x8 in. This is the 1916 edition which is a complete revision of the old edition showing many new shapes of refractories and filtering apparatus.

Leadville Drill Column Hoist. The Hendrie & Bolthoff Manufacturing & Supply Co., Denver, Colo. Bulletin. Pp. 16; 6x9 in. Illustrated. This contains description of a new hoist known as the "Super-Leadville."

"National" Matheson Joint Pipe. National Tube Co., Pittsburgh, Penn. Pamphlet. Pp. 72. 8x10 in.

This is the third edition of this pamphlet, enlarged and revised and contains good illustrations of installations.

"Concrete Swimming and Wading Pools" is the title of a new publication of the Portland Cement Association, 111 West Washington St., Chicago. It describes the construction of simple pools, and may be obtained without charge upon request.

Boiler Tube Cleaners. The Lagonda Manufacturing Co., Springfield, Ohio. Catalog L-9. Pp. 36. 8x10 in. This illustrates and describes the different types of boiler cleaners and other specialties made by this company, including reseating machine, strainers, filter and grease extractor, etc.

Iron Cements, Paints, Etc. Smooth-On Manufacturing Co., 570-574 Communipaw Ave., Jersey City, N. J. Smooth-On Instruction Book No. 16; pp. 144; 4½x6½ in. This contains many new examples and illustrations showing the working of the different Smooth-On iron cements and ought to be useful to mining engineers.

Poppet Valve Engines. Nordberg Manufacturing Co., Milwaukee, Wis. Bulletin No. 28. Pp. 36; 8x10½ in. This describes three types, namely, full poppet, poppet-uniflow and poppet-corliss and tells which engine is best suited to plant conditions. Tables of tests and illustrations showing details of construction are included.

"Productos de la Ingersoll-Rand." Ingersoll-Rand Co., 11 Broadway, New York. This is a 124-page catalog printed in Spanish covering complete line of air and gas compressors, pumps, rock drilling, metal and coal mining, prospecting and quarrying machinery, pneumatic tools for machine, boiler shop and foundry work.

Insuluminum. Diamond Power Specialty Co., Detroit, Mich. Bulletin 118. Pp. 8; 7½x10½ in. This bulletin contains a number of photo-micrographs and describes the properties of this metal, which is a recent product of the General Electric Co.'s laboratories and which has very high heat resisting qualities. Application of this metal to the Diamond Mechanical Soot Blower System is also shown.

INDUSTRIAL NEWS

Morse Bros. Machinery and Supply Co., of Denver, has purchased the crushers, rolls, roasters and cyanide equipment of the Lord Byron mill at Sugar Loaf, Colo., and shipped them to Denver for resale.

The Crocker-Wheeler Co., Ampere, N. J., announces that its San Francisco district office, Mr. W. K. Brown district manager, has been removed from the Crossley Building, 619 Mission St., to the ground floor of 87 New Montgomery St.

Penn Development Co., 836 Real Estate Trust Building, Philadelphia, Penn., has been organized for the purpose of developing and financing mines and prospects and industrial enterprises. Propositions will be considered and examined.

Chemical Products Co., Washington, D. C., has recently started its new tungsten plant at Anacostia, D. C. The principal product is a ferro-tungsten powder higher in tungsten than ordinary ferro-tungsten and exceptionally low in carbon, sulphur and phosphorus. A typical analysis is 87.7% W, 0.11 C, 0.46 S and 0.022 P. Various tungsten alloys will be made later.

Morse Chain Co., Ithaca, N. Y., has lately increased its capital stock from $400,000 to $1,500,000 for expansive purposes in the form of new buildings and additions to old ones already under way. When these buildings are completed, the company will have a total floor space of approximately 7 acres, all of which will be devoted exclusively to the manufacture of Morse rocker-joint power transmission.

Nordberg Manufacturing Co., Milwaukee, Wis., has received orders for steam hoists for the Davis-Daly Copper Co.; two air hoists for the Anaconda Copper Mining Co.; electric hoists for the Elm Orlu Mining Co. and Butte & Superior Co.; two for Utah Apex Mining Co., and for St. Louis Smelting and Refining Co. and Phelps, Dodge & Co.; Globe and Nacozari; Federal Mining & Smelting Co.; Hercules Mining Co.; Cerro de Pasco Mining Co. and Furukawa Ashio Mining Co., Japan. The company also states that it is now building a number of Nordberg-Carels Diesel Engines for various mining companies in the West and Southwest.

Westinghouse Electric and Manufacturing Co. has received the order for the electrical equipment for the new mill of the Alaska Juneau Gold Mining Co., at Juneau, Alaska. The order covers an electrical apparatus for the mill and two substations, among which may be mentioned two 300-kw. rotary converters with transformers; two 18-ton tandem locomotives; two 400-hp., thirteen 225-hp., and thirteen 150-hp. induction motors; two 350-hp. synchronous motors and exciters; two 300-k.-va. synchronous motors; 15 smaller motors; one 100-kw. motor-generator set and a 17-panel switchboard.

Editorial Correspondence

SAN FRANCISCO—Aug. 30

Mother Lode Gold-Mine Owners of eleven properties in Amador County will post notices on Sept. 2 regarding a contemplated wage demand of employees. The owners declare that they will close the mines rather than increase present wages. The announcement follows. "It has come to our notice that some of the workmen in our employ contemplate demanding in the near future a material increase in wages and shortening of the hours of labor, and much as we regret it, we feel obliged to state firmly and positively that should such demands be made they will be refused, and if then insisted upon, we shall be obliged to close our mines indefinitely. Our reason for this stand is as follows: We recently made a voluntary increase in the wages of our employees, because we thought they were fairly entitled to such increase. While it is true that, because of the higher price obtained for their product, the copper mines in California are paying higher wages than are paid in Amador County, this constitutes no reason for an advance in the wages of gold miners. We are receiving no more for our product than at any other time, and on the other hand are burdened by a much greater expense for all classes of supplies; and, beside which, on the Mother Lode the average grade of the ore is low and the industry is generally conducted on a narrow margin of profit; for while a mine is sometimes profitable for a few months it may be operated at a loss at other times. We have shown our willingness to act fairly in the matter by dividing with our employees the burden due to a higher cost of living and feel that we have already done all that the state of the industry will stand." This announcement has been signed by the Argonaut Mining Co., Bunker Hill Consolidated Mining Co., Central Eureka Mining Co., Consolidated Amador Mining Co., Fremont Consolidated Mining Co., Kennedy Mining and Milling Co., Keystone Mines, Original Amador Consolidated Mines Co., Plymouth Consolidated Gold Mines, Ltd., South Eureka Mining Co. and Treasure Mining Co. [Later. Dispatch from Jackson, Calif., Sept. 5, states that secretary of miners' union announces report of contemplated strike entirely unfounded. No action contemplated by union.]

BUTTE—Aug. 31

Anaconda's Expansion continues. With the recent acquisition of the Walker copper mine in Plumas County, Calif., another state is added to those in which the Anaconda Copper Mining Co.'s ramified interests are active. Montana, of course, comes first containing as it does, the company's large copper and zinc mines, the enormous reduction works at Anaconda and Great Falls, the Butte, Anaconda & Pacific Ry. connecting Butte with Anaconda, extensive coal mines and large tracts of timber lands that supply its mines with the necessary lumber. Outside of Montana the company has an option on the Douglas zinc-lead property in the Cœur d'Alene district in Idaho. In Utah it owns and operates the International custom smeltery at Tooele. In Wyoming various coal mines. In Arizona it owns the new custom smeltery at Miami and control of the Inspiration mines at the same place. In Mexico it holds a stock interest in Greene-Cananea. In the East Chicago district the company owns the International lead refinery and at Perth Amboy, N. J., the Raritan copper refinery. In South America the company's subsidiary, the Andes Exploration Co., is developing a large disseminated deposit at Potrerillos, Chile, back from Chañaral. Anaconda also owns the United Metals Selling Co. in New York which markets about 600,000,000 lb. of copper per annum.

DENVER—Aug. 30

Fatalities in Mines, Mills and Smelteries of the state through accident have decreased 40% during the year ended July 31, according to figures compiled by M. B. Tomblin, deputy commissioner of mines. He ascribes the betterment directly to rigid enforcement of laws and rules regarding safety.

Abstention from Politics is to be the rule for employees and officials of the Colorado Fuel and Iron Co. Recently the board of directors published a statement that all employees and officials must keep absolutely out of "politics." The company will brook no interference with the political privileges of any of its men.

Cresson Consolidated in the Cripple Creek district is a common topic for discussion among mining-stock speculators. Brokers are carrying large "display ads" advising purchase of this stock and promise monthly dividends of from 8% to 10%. Par value of the stock is $1 but it is not offered at less than $5.10. Officials state that there is blocked ore to the value of $5,000,000. The dividend rate was one of the matters to be decided at a meeting of directors, Aug. 28.

Geologic Field Work Northwest of Twin Lakes, along the continental divide, has just been completed by J. V. Howell who has been in this region all summer, under the auspices of the Colorado Geological Survey, and will shortly prepare his report. His primary object was to discover sedimentary rocks in this region, none having heretofore been reported, and he succeeded to the extent of finding a considerable mass of blue limestone apparently entangled in a flow-mass of rhyolite. During the coming year, Mr. Howell will be connected with the geological staff of the Standard Oil Co., with duties probably in the mid-west.

Tungsten Legislation is to be presented to the next Congress. The Colorado Metal Miners' Association, through its president, Bulkeley Wells, has appointed the following prominent tungsten operators a committee to formulate proposed legislation relative to the protection of the American tungsten-mining industry: Harold Boericke of the Primos Mining Co.; Robert W. Kerry, of the Rare Metals Ore Co.; J. A. McKenna, of the Vasco Mining Co.; William Loach of the Wolf Tongue Mining Co.; and J. G. Clark of the Boulder Tungsten Production Co. Despite the depression in the tungsten market, development of mines and the equipment of new milling plants for concentration of tungsten ores continues in Boulder County. The Intermountain Tungsten Milling Co. is remodelling an old gold mill at Salina; while the Tungsten Mountain Mines Co., a concern closely allied with the Boulder Tungsten Production Co. and managed by "Jack" Clark, has been re-financed and will renew the work of driving a deep crosscut adit.

LEADVILLE—Aug. 31

The Robinson-Kokomo District in Summit County is in the midst of the greatest boom of recent years, as a result of the activity of the Progress Mining and Milling Co. The Progress company has taken over the old Wilson mill and a number of the large mines of the section. The mill has been entirely remodeled and is now equipped with a modern flotation process for the better separation of the lead-zinc ores of that locality. Ore is purchased from all mines in the district, offering a ready market for ores that for some time could not be handled profitably. It is stated that there are now fourteen mines operating in the district where a year ago there were but three or four. The most important ore discovery that has been made in the Robinson section in several years is the uncovering of rich gold-silver-lead ore in the old Columbine property. A 3-ft. vein has given assays as high as 4 oz. gold, 786 oz. silver and 10% lead. The finding of the ore was accidental. Men were employed digging a drain in the stope bottom and picked into the ore. Two shipments have been made by the Leadville men, who are operating the property.

Drainage has been the feature of this year's mining in Leadville. The draining of the Down Town basin is now complete. The big station pump and 650-hp. motor have been installed at the bottom level. Water column has been connected with the pump which is now throwing 2,000 gal. per min. to surface against a head of 870 ft. One sinking pump continues to operate in connection with the relief pumps at the 450-ft. level as the total flow in the property ranges from 2,500 to 2,800 gal. Mining is being undertaken throughout a large section of the property and hoisting is being done through two compartments. Surface rights around the Penrose have been purchased by the company for dump room. This territory was for the greater part occupied by residences which are being moved to other locations. At the Harvard shaft, Manager H. S. Lee is now lowering the water rapidly, after having reduced the flow to 300 or 500 gal. per min. by fluming the gulch water past the property. Preparations are being made to drain the Greenback mine, owned by Patrick Mulrooney. A Layne-Bowler centrifugal pump of 1,000 gal. capacity has been ordered for the unwatering. It

will be driven by a 150-hp. motor now installed at the 900-ft. level. The shaft has been retimbered from surface to the 900 level and the station at that point has been enlarged for the reception of the motor. A large steam-pumping plant is installed at the 900-ft. station and will be used as a relief plant. The Greenback is the deepest shaft in this section, having been sunk to 1,350 ft. The draining of the Greenback is looked upon as one of the most important developments in the unprecedented mining revival that has prevailed throughout the past six months, as it means that the Leadville district is to be explored at great depth.

SALT LAKE CITY—Aug. 31

Increased Smelting Capacity is to be provided both at the Garfield and the Murray plants of the American Smelting and Refining Co. The increase to be made at the lead smeltery at Murray will include the enlargement of the furnaces and a new stack, 450 ft. high. This stack will be the second highest in the world. There has been an unusual congestion of ores at the Valley smelteries as the result of increased production induced by high metal prices, and the increased capacity will make possible larger shipments from mines that have lately been obliged to curtail their output.

Physical Property of Ohio Copper Co. was bid in for $750,000 by E. H. Sykes, of Sullivan & Cromwell, New York, counsel for the bondholders, at public sale taking place Aug. 30, following the order of Judge M. L. Ritchie of the district court denying the motion of persons seeking to intervene and postpone sale. Mr. Sykes made an initial bid of $500,000 for the property, against which there is a judgment of over $1,500,000. There were no other bidders, and to make the sale legal, a second bid for $750,000 was entered; and the property acquired. The bonds of $650,000 will be applied on the judgment of $1,500,000. Immediately after the sale a bill in equity, asking for the setting aside of the sale and the judgment in the foreclosure suit, was filed in Judge Ritchie's court. S. A. Maginnis, of counsel for the stockholders, who sought to prevent sale, said that the case would undoubtedly be carried to higher courts.

Transportation of Ores in Big Cottonwood Cañon by means of tractor trains has thus far proved unsatisfactory, and teams are again being introduced. A short time ago, through the coöperation of the mining companies with city and county, the cañon road was put in order, and hauling by tractors started, the object being to protect from contamination city water coming from the cañon. The Mines Transportation Co.—organized to haul ores from the Cardiff and Maxfield mines—having been unable, owing to the steep grade, to put on a sufficient number of trailers to make operation profitable, has made an assignment; and the mines are left with the problem of bringing their ores to market. Following a notice from the city water department, the Cardiff company informed a joint meeting of the city and county commission that, inasmuch as the city and county had failed to carry out their part of the agreement, the road not being in such condition as to permit the successful use of traction trains, the mining companies were not legally bound to observe their part of the contract requiring the exclusive use of tractors, and that they were proceeding to use horses, and would continue to do so, unless the teams could be successfully replaced by motor trucks. It was stated that the road could not be put in condition for the successful use of traction trains for less than $50,000 in excess of the $30,000 contributed by the city and county, and the mining companies jointly. Further procedure in the matter will be held in abeyance, pending a thorough examination by city and county physicians of sanitary conditions in the cañon.

SPOKANE, WASH.—Aug. 30

Marketing Department of Bunker Hill Smeltery is to be established at San Francisco under the direction of Myron A. Folsom, who has been widely known in the Northwest as a mining lawyer and for the last 17 years counsel for the company in the Coeur d'Alene region. Mr. Folsom will remove about Oct. 1 to San Francisco, where he will continue to handle the legal business of the company in addition to the work of the new department. It was largely through Mr. Folsom's efforts that the site at Kellogg, Idaho, was selected for the company's new smelting plant. He was commissioned by President F. W. Bradley to overcome the transportation difficulties and in this connection solved various other problems that were factors in the determination of the smelting-plant site, so that the works now under construction at Kellogg are a testimonial to his exceptional combination of business and professional ability, and his selection as head of the commercial and legal department the recognition of that talent.

The Day Interests, the controlling factors in the Northport Smelting and Refining Co., are extending their mining activities. Their principal interests in the Coeur d'Alene district include Hercules, the Ray-Jefferson and the Tamarack & Custer. Announcement is now made in the "Daily Press-Times," the Day organ at Wallace, Idaho, of their entrance into the Republic mining district in Ferry County, Washington, through the purchase of control of the Republic Consolidated Mines Co. holdings. These include the Lone Pine, Surprise and Pearl gold mines that had been considerably developed by the original company, the Republic Mines Corporation, which went into the hands of a receiver about three years ago. It is assumed that the ores are wanted for fluxing purposes at the Northport smeltery. The entrance of the Day interests into the Republic district is expected to result in further activities from other outsiders, as well as to stimulate some of the local interests of the camp.

JOPLIN—Sept. 2

No Concerted Shutdown of Mines was the decision reached by representative mine operators of the district at a recent meeting. With representatives from most of the camps, the proposition of shutting down, until the surplus ore now held in bins is taken up, was discussed from various angles and it was decided in the end that there would be no attempt to bring about a concerted shutdown. A number of individual operators, however, announced their intention of closing down.

The Purchase of the Franklin Mine for $50,000 by Lown & Hastings, of Duenweg, was one of the interesting events of the week. This is a sheet-ground property in the Duenweg section of the district but the mine has been in the hands of a trustee in bankruptcy for some time. The purchasers are experienced in the Duenweg field, having developed the Baltic mine, which they sold two years ago for $125,000.

Abandonment of Miners' Clinic now confronts the dispensary established by mine operators of this district at Webb City about three months ago. Dr. D. R. Hill, of Joplin, who has been connected with the dispensary since it started has resigned, and no one has been named to take his place. It is likely that the poor ore market will mean the abandonment of the plan to keep a physician at the dispensary daily, though a visiting nurse will be employed as before. The whole dispensary idea was the result of investigations by Dr. A. J. Lanza, of the Public-Health Service, and a report of his findings to the Southwest Missouri Mine Safety and Sanitation Association.

ISHPEMING, MICH.—Sept. 1

The Large Output of Iron Ore is exceeding the capacity of the boats to carry the product of the mines, although iron ore is moving to the docks at lower Lake ports at an unprecedented rate. Though numerous stockpiles are being cleaned up, there will be plenty of ore in stock on the Michigan ranges when navigation closes for the season. One operator stated the other day that his company had disposed of about 3,250,000 tons for 1916 delivery, but the ore in stock and the amount coming from the shafts would be considerable more than had been sold. More ore could have been disposed of if boats could have been secured to take the cargoes. This company has a large fleet of its own. The Steel Corporation early last fall chartered a lot of boats for this year and other years to come before the independents were aware of what was going on. It seems certain that there will be an increase in Lake freight rates next year, as the demand promises to be greater than ever. The mining men are also looking for an advance in iron-ore prices, as the increase for this year was not in proportion to the advances in pig iron. The prices for 1917 delivery will probably be made early, as will also the boat rates.

DULUTH, MINN.—Sept. 1

In the Strike District on the Mesabi Range the only important development this week, was the indictment of eight men for the murder of Deputy Sheriff James Myron, of Duluth, who lost his life when he went to serve warrants on several strikers in Biwabik. Five of those held are strikers. The other three are agitators who are held for inciting the strikers to commit acts of violence. The trial will start soon at Virginia. William D. Haywood, head of the Industrial Workers of the World, has been appealed to by the strike leaders to start a movement for a national strike, in the hope that a sympathetic strike will aid the cause of the men who are held for murder.

Ore Shipments for August from the head of the lakes were as follows: Over Duluth, Missabe & Northern, 3,380,066 tons; Duluth & Iron Range, 1,534,314; Great Northern, 1,694,899; Soo Line, 190,577; Northern Pacific, 64,870; total, 7,864,726 tons. The above includes only the shipments from Duluth, Two Harbors and Superior, and does not take into consideration the shipments from Ashland, Marquette and Escanaba. It is thought that the total movement for the month will be in excess of 10,000,000 tons.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—In July, mill ran 23.2 days crushing 14,385 tons, yielding $18,930 or $1.33 per ton; operating expense $22,094; operating loss $3,164; construction expense $2,424; net operating loss $5,588; other income $3,730.

ALASKA TREADWELL (Treadwell)—Crushed in July 77,721 tons yielding $155,890 or $2.03 per ton; operating expense $98,727; operating profit $57,163; construction expense, $12,326; net operating profit, $44,856; other income, $11,281.

ALASKA UNITED (Treadwell)—In July, crushed in Ready Bullion mill 23,660 tons and in 700-ft. Claim mill 21,350 tons, yielding $49,716 or $2.12 per ton and $23,595 or $1.12 per ton; operating expense $31,823 and $45,621; other income, $3,730. Ready Bullion operating profit $17,893, construction expense, $4,489, net operating profit $13,403; 700-Ft. Claim operating loss, $22,026, construction expense $6,848, net operating loss, $28,874.

ARIZONA

Greenlee County

SHANNON (Clifton)—August estimated production about 925,000 lb. copper.

Mohave County

KEYSTONE (Chloride)—Work to be started at once on 100-ton mill for this Mineral Park mine.

NORTH GEORGIA (Chloride)—Lead ore encountered in both east and west drifts on 100-ft. level. Now working three shifts.

TENNESSEE (Chloride)—Strike called Aug. 25, settled next day by increasing cagemen's wages from $4 per day to union scale of $4.50.

BIG JIM (Oatman)—Still developing ore in spite of statements of Los Angeles stock brokers. Company will take no action against recent attacks in brokers' letters, but it is expected that individuals will soon bring suit for libel.

CALIFORNIA

Butte County

CHROME DEPOSIT disclosed on the Nat Lambert, near Magalia, within 4 mi. of Butte County R.R. Considerable ore already blocked out.

1915 GOLD MINING CO. (Lumpkin)—F. C. Burroughs and A. L. Thorselius, owners, completed and are running two-stamp mill on good-grade ore.

NATOMAS CO. (Oroville)—Feather River dredge reported to have started digging into old tailings pit to ascertain if tailings of Oroville district will pay to redredge.

GOLDEN FEATHER RIVER MINING CO. (Oroville)—New company to be incorporated for working gravel claims for 6,000 ft. on middle fork of Feather River. Paul Reicker, Marshall Curran and George C. Riley, located the claims.

TRIUMPH GOLD MINING AND MILLING (Lumpkin)—Company will resume operations under new management, installing compressor and drills and driving new working tunnel 750 ft. lower. F. A. Thompson, superintendent. Property, equipped with 25-ton mill and cyanide plant, has been operated for some time by lessees.

Calaveras County

HEXTER (Mokelumne Hill)—Rich gravel reported at Stockton Ridge channel. Mine equipped with machinery; gravel hauled through 3,000-ft. tunnel by electric locomotive. George Chapman, superintendent.

CALAVERAS (Melones)—Old tunnel cleaned out and retimbered 1,200 ft. Compressor and drills in operation. W. J. Loring is general manager. J. A. Davis, formerly of Central Eureka, Amador County, is superintendent.

TEXAS MINING CO. (Stockton)—Permitted to sell 100,000 shares at 25c. to develop copper claims, and to issue half of its capital stock to J. R. Hoskinson and six associates in payment for the claims. These shares to be issued only as other shares are sold for cash, in order to preserve equitable balance of voting power by original owners and investors.

Eldorado County

OMO RANCH DISTRICT is active, many properties being prospected or operated. C. Edner is preparing his gravel mine for winter operation. Ensley mine shaft being sunk preparatory to development. Slug Gulch getting ready for winter work. Tony Merrell is drifting on good gravel. Lynch company working its gravel mine.

BEEBE (Georgetown)—Property being prospected by Georgia Slide operators.

TAYLOR (Placerville)—Tailings may be re-cyanided by O. H. Shade, of Los Angeles. Treating 6 to 10 tons a day and a 30-day test is to be made. Dump was treated several years ago.

Glenn County

CHROME MINES have difficulty in securing miners. Construction of tramway from mine to Fruto contemplated. Roads in winter require much work to keep them in order.

Inyo County

ORE SHIPMENTS from Keeler amount to 24 to 28 cars a day. Cerro Gordo continues regular shipments; Saline Valley Salt Co., Natural Soda Products Co. and Inyo Development Co. also shipping.

DARWIN DEVELOPMENT CO. (Darwin)—Successful operation of flotation plant reported. Two more units will be added.

Nevada County

CALIFORNIA COPPER (Spenceville)—H. W. Morris and Thomas Benney have purchase bond and contemplate erecting mill.

EMPIRE (Grass Valley)—Moving-picture company selected this mine as the stage for a mining-camp photoplay; 100 miners to be employed in the picture to give verisimilitude.

UNION HILL (Grass Valley)—Last payment on purchase price will soon be made. Mine has produced large amount of tungsten ore within past six months, although it is a gold mine which is being brought again into the producing class under management of Erroll McBoyle.

DELHI CONSOLIDATED MINES CO. (Nevada City)—Incorporated with capitalization $1,000,000. Directors are Roy E. Tremoureux, Carroll Searls, L. P. Larue, Frank Vestal, C. R. Clinch. Will operate Delhi mine, recently bonded from St. Gothard company.

Placer County

GUGGENHEIM INTERESTS reported to be preparing for prospecting dredging ground on north fork of the American River between Auburn and Colfax.

Shasta County

GARDELLA DREDGE (Redding)—Cleanup from 10 days' operating in Clear Creek, amounted to $4,576. Bullion averaged $18.30 per oz.

Siskiyou County

WHACKER (Yreka)—Being operated by Spring Gulch Mining Co. Ore low-grade but it is believed large tonnage can be extracted economically.

KNOW-NOTHING (Etna)—North extension of Gold Run vein recently purchased by W. R. Beall, former owner of the Gold Run. Equipped with 8-stamp mill.

GOLD RUN (Etna)—J. Claghoff, of New York, recent purchaser, is installing saw mill, hoist and pumping plant. Rails for tramway and other machinery ordered.

Yuba County

PACIFIC NO. 5 DREDGE (Smartsville)—Launching of 9-cu.ft. dredge on Aug. 23 by Pacific Gold Dredging Co. Mr. Perring was superintendent of construction. O. C. Perry, of Oroville, is manager. Dredging ground north of Hammonton, on Yuba River.

COLORADO

Clear Creek County

SUMMIT (Idaho Springs)—Being reopened for exploration at depth.

ARGO (Idaho Springs)—Flotation process at mill giving satisfactory results.

GOLD QUARTZ (Alice)—Development will be resumed and veins opened at greater depth. W. C. Bickford, manager.

BEN HARRISON (Idaho Springs)—Lessee Robert Calvert made trial shipment to Jackson mill, resulting in 50% lead concentrate.

T. P. (Idaho Springs)—Being developed by McCampbell and associates through War Eagle workings. Quito compressor and drills will be used in new crosscut.

AMERICAN SISTERS (Georgetown)—Lode claims, placers, mill sites and water rights will be sold at public auction in Georgetown Sept. 12, to satisfy judgment of $39,551 in favor of International Trust Co. of Denver.

STANLEY MINES CO. (Idaho Springs)—These properties, in Spanish Bar, Coral and Trail Creek mining districts, purchased by Fisher, Cunningham, Johnson and associates. Extensive development contemplated. Total past production estimated at $3,500,000.

Park County

J. G. BLAINE (Alma)—Shoot of tungsten ore of considerable importance opened recently. Vein is quartz, 4 to 6 ft. wide with a 4- to 12-in. shoot of tungsten ore assaying over 10%, some of it as high as 30%. Several other tungsten discoveries made in Alma district lately. On Esmeralda, a continuation of Blaine, high-grade float found. Tungsten also found on Mt. Loveland, across Buckskin Gulch.

San Juan County

EMMA (Silverton)—Mine in Ice Lake Basin being opened.

LACKAWANA (Silverton)—Leased to William Lonergan and James Fox.

NATIONAL BELL (Red Mountain)—Being developed by Davey Leasing Co.

CHAMPION (Silverton)—Shipments being made to Silver Lake mill. Frank L. Ross in charge.

ADAMS (Gladstone)—L. C. Carruthers, lessee, opened payable tungsten ore. Trial shipment sent to North Star mill.

KENO (Ironton)—Ross, Dougherty & Co., lessees, opened oreshoot assaying $40 a ton in upper tunnel. Working in both upper and lower tunnels.

KITTIMAC MINE & MILL CO. (Silverton)—New company to acquire under lease and bond property of Kittimac Mines Co. Joseph Jacob will be superintendent of the mine. New machine drills being installed and extensive development planned, including opening of Caliber vein. P. M. Collins of

American Flotation Co. is in charge of mill operations. New staff also include Isaac Camp, tramway superintendent; A. D. Malchus, assistant manager, and James M. Hyde, consulting flotation expert.

San Miguel County

DUFFY (Ophir Loop)—Being developed by Purdy, Scanlan & Lyle.

LITTLE MARY MINING CO. (Ophir)—Ten men employed on development; mill level and level above being advanced.

GERTRUDE (Telluride)—Property at head of Bear Creek Basin leased by Farrell and King. New mining equipment installed.

CARBONERO (Ophir)—Contract let to advance Shoofly crosscut 250 ft. L. H. Rouse, of Colorado Springs, owner and manager.

LEGAL TENDER (Telluride)—R. M. McLaughlin has opened rich 6-in. vein on this Mt. Wilson property, near Silver Pick mine; altitude 13,400 ft.

NELLIE (Telluride)—Being developed under lease by F. B. Van Atta and L. Munchiando. Aërial tramway will be built to 10-stamp mill on Bear Creek. Mill has been overhauled.

CARRUTHERS LEASE (Pandora)—Perino and associates have let contract for small quartz mill near Royer Creek and an aërial tramway 2,600 ft. long. Plant to be ready in October. Construction of mill under direction of Walter L. Reid; tramway to be erected by O. M. Sackett.

BLACK BEAR (Pandora)—Four levels advanced each way on the vein from inclined shaft. Vein 4 to 8 ft. wide and assays about $7 a ton. Ore treated in Smuggler-Union mills. About 65 men employed on development and about 3,000 tons per month are produced from drifting operations. Lowest level 450 ft. below the surface; collar of shaft at an altitude of 12,400 ft.

Summit County

MINNIE (Breckenridge)—Recently unwatered by Wellington company. Extensive development work will be started at once.

SILVER KING (Breckenridge)—Iron-manganese ore discovered recently. Vein is of considerable width and apexes only a few feet from surface.

COLORADO METALS SEPARATION CO. (Breckenridge)—Alterations in old Union mill completed; will now treat custom ores. Ore from the Country Boy to be treated.

Teller County

GOLD PINNACLE GOLD MINING (Cripple Creek)—Developing through Mitchell shaft. Payable ore opened.

DILLON (Victor)—New ore house will enable operators to increase output to 150 tons a day. Daniel McCarthy, superintendent.

PORTLAND (Victor)—New sampling plant is under construction at the mine and a new assay office at the mill at Colorado Springs.

ACACIA (Cripple Creek)—Fitzmorris & Quinn developing on 12th level of South Burns shaft. One-ounce gold ore opened on extension of Eagles vein.

AJAX (Victor)—Payable ore has been opened near the surface on Block 13 by Charles Hill. A 30-ft. shaft cut orebody averaging $15 to $20 a ton; extent not yet determined.

REX GOLD MINING & MILLING (Cripple Creek)—Mill on Ironclad Hill treating from 60 to 75 tons a day. Oxidized ore is being quarried from opencuts; expense of treatment reported at $1.25 per ton; considerable $4 ore opened. Thomas Kavanaugh, manager.

ISABELLA (Cripple Creek)—During July shipped 65 cars of ore, about 1,725 tons; gross value approximately $38,000; profit about $10,000. Of entire production 14 cars were on company account; nine cars of milling ore and five cars of high-grade ore were from Beuna Vista oreshoot recently developed in 15th level. Development being done by lessees through the Lee, Empire and Maloney shafts. Clark Mitchell is superintendent.

MICHIGAN

Iron

CRYSTAL FALLS MANGANIFEROUS DEPOSIT, opened two weeks ago, is not believed to be large. Diamond drill cut through 5 ft. of this ore; core averaged 35.50% manganese; ore was only 28 ft. from surface. Drill hole 100 ft. away did not strike manganese. Further drilling now being done.

SECTION 16 (Ishpeming)—First-motion hoist at the Queen mine now being installed at the Section 16. Old hoist will be discarded.

RICHMOND (Palmer)—About 250,000 tons will be shipped from this property, this year, breaking all previous records. More stripping is to be done in the spring. All machinery now operated electrically.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—Contracts awarded for additions to change houses at the Lake and Cliffs mines; not room enough for large crews now being worked. New shop will also be erected at the Cliffs.

YALE (Bessemer)—Steel headframe and shaft sets ordered for new shaft and work will be started shortly. The shaft will go down on the Jackpot property of Jones & Laughlin Ore Co. which adjoins. New lease recently signed on the Jackpot. All present mine buildings of the Yale are on the Jackpot land but shaft now in use is on the Yale.

MINNESOTA

Cuyuna Range

JOAN MINING CO. (Ironton)—Started sinking two-compartment shaft, 5 ft. 8 in. by 10 ft., in manganiferous deposit. No railroad connections yet.

Mesabi Range

BRUNT (Mountain Iron)—Two shovels working; ore taken to drying plant; when dried is stocked in pit owing to car shortage.

HAWKINS (Nashwauk)—Stripping for season finished at pit. From washing plant, 5,000 tons of concentrated ore a day being shipped.

HANNA A (Mountain Iron)—Shipping now in progress. Pit about 200 ft. deep. Four switchbacks, with steep grades, used in removing ore.

MINORCA (Virginia)—Will be reopened and operated by local men headed by John Costin, Jr. Formerly operated by Pickands-Mather Co. but lease was dropped.

SUSQUEHANNA (Hibbing)—Rogers-Brown company working on model power house. Heavy pumping equipment will be necessary later; present flow about 3,000 gal. per min. Screening plant in operation.

SLIVER (Virginia)—One shovel operating in manganiferous ore. M. A. Hanna Co. will ship this season from this mine 40,000 tons containing 3% manganese. Underground loading machine, recent invention of Captain Hoar, is in operation.

MISSOURI

Joplin District

T. C. H. (Commerce, Okla.)—Started milling ore from old Eureka drifts.

SMITH (Galena, Kan.)—Contract let for drilling of M. L. Smith farm, 4 mi. southwest of Galena.

LONE ELM (Joplin)—Ten new shafts going down on this "poor man's" tract. Some good strikes made.

CRAMER (Cave Springs)—Mine closed; mill sold to Keyes and associates, who will move it to site near Commerce, Okla.

C. M. & H. (Joplin)—Installed 6-in. American pump in Glendale shaft to drain ground 30 ft. deeper than now being worked.

LOG CABIN (Galena, Kan.)—Once well-known mining tract being thoroughly redrilled for ore at deeper levels than originally worked.

FLANNERY (Sarcoxie)—Opened old Optimo ground by new shaft. Plan to solve water problem by concrete bulkhead near original shaft.

COAHUILA (Duenweg)—Slime plant at new mill started with 16 tables. Four more to be added later. Mill averaged 1,800 tons daily.

QUEEN CITY (Commerce, Okla.)—Started after month's idleness, mainly to hold force together, owners claiming no profits at present prices.

SCOTT (Duenweg)—Drill hole 400 ft. south of mill shows 9.9% blende for 42 ft.—from 231 to 271 ft. New double-compartment shaft, property's fourth, to be sunk on hole. Mill closed, ore bins full, awaiting better market.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Preparing to sink shaft to connect with raise from the long tunnel. Will install hoist and compressor plant.

Broadwater County

IRON MASK (Townsend)—Will be reöpened soon; purchased by Edward Taylor, James Jobb and Albert Richards, of Helena.

BALD BUTTE (Marysville)—Tower & Templeman, of Butte, are constructing 150-ton cyanide plant to treat tailings dump estimated at 325,000 tons.

Jefferson County

INDEPENDENT (Wickes)—L. G. Knotts, owner, shipped recently carload of ore to East Helena smeltery and has another car nearly ready.

Lewis and Clark County

MONTE CRISTO (Rimini)—W. A. Clark, Jr., developing this property has stopped work and given up lease.

Madison County

CONREY PLACER MINING (Ruby)—Output during year ended Aug. 31 was greatest in company's history. More than 22,000 cu.yd. of gravel washed daily by company's four dredges. Alder gulch in which these dredges are operating is being worked for the third time. In the early '60s it was "drifted" by the first gold seekers, and in the '70s was ground-sluiced.

Missoula County

TARBOX (Saltese)—New equipment, consisting of an air compressor, power drills, etc., being installed. Shaft nearing 500-ft. level, where station will be cut and crosscut driven south to vein.

Powell County

WASHINGTON GULCH PLACER (Avon)—P. A. Danaher, of St. Paul, has purchased this 105-acre property, and will install hydraulic elevators of his own invention.

Silver Bow County

BUTTE & ZENITH CITY (Butte)—Shaft is expected to reach the 1,000-ft. level Sept. 1. On this level, 600-gal. Imperial Iron Works pump will be installed and crosscutting started to intersect the Economical vein.

BUTTE-MAIN RANGE (Butte)—Retimbering shaft from surface to 600-ft. level completed. When unwatered to 700-ft. level, crosscut will be driven to intersect orebody. Drifting on 500-ft. level opened good ore and wagon shipments will be started shortly.

ANACONDA (Butte)—Early on Aug. 26, fire starting from electric motor in shaft house of East Stewart mine damaged fans but as this shaft is upcast, was put out by fire department without damage to shaft. At the Tropic, a new 5-ton Pierce Arrow truck has been substituted for teams formerly used to haul ore to railroad.

BUTTE-DULUTH (Butte)—Development work planned by leasing company under direction of Al Frank will include

cleaning of Montgomery shaft and sinking to 1,000-ft. level. Old mill will be changed to accommodate new process. Receiver Everett who will remain with new management, recently took in $6,100 from sale of machinery to Max W. Atwater.

BUTTE & BACORN (Butte)—At company's property in northern section of Butte district, great activity is being shown after shutdown of nearly 10 years. New 70-ft. gallows frame completed and buildings overhauled. Excavations for boiler, compressor and hoist made and two 125-hp. boilers are on ground. New management under name of the Greater Butte company expects to start operations by Oct. 1. Retimbering of shaft and all necessary work for opening mines on 1,000-ft. level will soon be completed.

NEVADA

Elko County

ELKO PRINCE (Midas)—The 50-ton mill is being operated steadily by Elko Prince Leasing Co. on ore from this and other properties. In Elko Prince mine, parallel vein 400 ft. distant from main vein is being drifted on north and south. From surface to within 90 ft. of where Elko Prince cut it, the ground is under lease to Paul Ehlers, one of original Elko Prince owners; three lots sent to the mill ran about $25 and he has developed about 1,000 tons of lower grade ore that will be stoped when the Elko Prince connects with his workings. Mill charges for treating custom ore are reported as follows: $5.50 for $12, ore, $6 for $20 ore, $7 for $30 ore, etc., paying for 85% of the precious metals.

Esmeralda County

SILVER PICK (Goldfield)—President Zadig states 3-ft. vein encountered in shaft at about 900 ft. Sinking suspended pending placing of larger pumps.

JUMBO EXTENSION (Goldfield)—During year ended June 30, 1916, property produced 35,541 dry tons ore, valued at $1,124,487, or $31.64 per ton, compared with an average of $61.58 for year previous. Dividend disbursements $465,100. Cash balance end of year $103,274, with additional $28,728 as value of ore in transit.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 26 was 8,916 tons, valued at $186,568, compared with 9,257 tons for week previous. Producers were: Tonopah Belmont, 2,824 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,500; Jim Butler, 1,100; West End, 875; Rescue-Eula, 204; Halifax, 155; miscellaneous, 58 tons.

MORNING GLORY (Manhattan)—Small electric hoist purchased and development will be begun. Property adjoins the White Caps.

REORGANIZED WHITE CAPS (Manhattan)—Ore in both the east and west drifts on 310-ft. level. Ore is complex and will require roasting.

EAST END DEVELOPMENT CO. (Tonopah)—Agreement to give Tonopah Belmont control for expenditure of $50,000 in development will be submitted to stockholders.

ORIZABA MINING AND DEVELOPMENT (Millers)—Silver property, about 32 mi. north of Millers, shipping several cars ore, valued at $50 per ton; control held by the Diamondfield Black Butte Reorganized Mining Co., of Goldfield.

TONOPAH EXTENSION (Tonopah)—July profit $69,209 from 8,139 dry tons, yielding $148,089 in bullion (1,680 oz. gold and 178,560 oz. silver). Victor shaft to be sunk 300 ft., electrical hoist placed on 1,540-ft. station for this purpose.

Storey County

ANDES (Virginia)—Saved 29 cars of ore from development on 350 level.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Repaired surface equipment and operated cyanide plant.

ALPHA & EXCHEQUER (Virginia)—North drift on 200 level advanced to 148-ft. point, entering new ground.

CON. VIRGINIA (Virginia)—West crosscut on 2,700 level advanced to 60-ft. point through vein porphyry carrying quartz and clay stringers.

OPHIR (Virginia)—Shipped from 2,500 level 20 tons of ore to Mexican mill. North drift on 2,700 level advanced to 300-ft. point, face in dacite and quartz.

SIERRA NEVADA (Virginia)—North drift 2,400 level advanced 20 ft., face in porphyry and stringers of quartz, low assay. North drift 2,500 level reopened and repaired to the 220-ft. point.

MEXICAN (Virginia)—West crosscut 2,500 level extended to 398-ft. point, face in diorite. Mexican mill received 352 tons custom ore, averaging $24.42, and 64 tons from Mexican storage pile, averaging $9.20.

UNION CON. (Virginia)—Extracted 332 tons: 2,400 level 66 tons, average $17.99, 132 tons $24.14, 74 tons $15.90, 39 tons $20.30; 2,500 level, 21 tons, $14.26. Reopening old 2,300 shaft station and advanced southeast drift on 2,400 level to 232-ft. point. Joint Sierra Nevada east crosscut 2,600 level advanced to 88-ft. point.

UTAH

Beaver County

COPPER KING (Milford)—This property in Star district leased by A. W. Windberg.

CEDAR-TALISMAN (Milford)—Lead ore being mined from lower levels. Little zinc ore handled at present.

UTAH LEASING (Newhouse)—Company, treating dump of old Cactus mine, has just placed in commission new flotation equipment and tables. Plant handling up to 800 tons a day and making good extraction.

Juab County

TINTIC SHIPMENTS for August amounted to 741 cars by 35 shippers.

DRAGON CONSOLIDATED (Silver City)—August output was 156 cars. Much iron ore being shipped.

IRON BLOSSOM (Silver City)—Drifting being done from winze on 1,200-ft. level in north end of property; and copper ore beginning to show.

LOWER MAMMOTH (Mammoth)—Low-grade ore opened on the 1,500 level is being raised on and showing improvement. Carries silver, lead and gold.

CHIEF CONSOLIDATED (Eureka)—Company shipped 151 cars in August, largely lead-silver ore of good grade, carrying some gold. Lower grade ores are not being handled much on account of present congestion at smelteries.

Salt Lake County

UTAH-APEX (Bingham)—New Nordberg hoist and other equipment is being installed at the shaft.

MONTANA-BINGHAM (Bingham)—New compressor is being installed. May contract for driving tunnel 900 ft. further. Present length 4,042 ft.

LEHI-TINTIC (Eureka)—Compressor and machine drills to be installed; Empire and Iron Blossom tunnels to be extended 100 and 200 ft. to get under orebodies exposed in upper workings. George Nicholes, manager.

UTAH COPPER (Garfield)—July production is reported at 20,302,228 lb. as compared to 17,877,432 lb. in June; and 15,950,215 in May. Cement and forms for leaching vats for new leaching plant are on the ground. Over 40,000,000 tons of carbonate ores accumulated for leaching.

EMMA COPPER (Alta)—Second diamond drill ordered and will soon be in operation. Faulted portion of Emma limestone—in which occurred famous old Emma orebody—thought to have been cut below Bay City tunnel. Drilling is being done jointly by Emma Copper and old Emma Leasing Co.

CONGOR (Bingham)—Raising being done from Bingham Amalgamated tunnel to connect with 600-ft. incline from surface, and to determine whether veins opened apex on Congor ground. Distance from tunnel to surface about 1,800 ft. on dip of beds and veins.

MICHIGAN-UTAH (Alta)—Between Aug. 1 and Aug. 26, there were shipped 36 cars. Company hopes to maintain this rate during autumn. Triangle lease shipped two cars from City Rocks and Grizzly veins. Lessees on Big Cottonwood side are mining ore. Company doing development in Copper Prince tunnel to reach known vein.

SELLS (Alta)—At meeting of directors, held Aug. 28, arranged to give mortgage on property; principal stockholders signed notes so that company could meet obligation of $25,000, due Sept. 1, on original portion of property and $5,000 on holdings later acquired. First planned to raise money by 6c. assessment; later reduced to 2½c. a share, this being all that was legally possible. As amount from assessment is not sufficient to meet immediate demand, cash was secured by mortgage.

Utah County

PACIFIC (American Fork)—Work progressing on mill on Dutchman Flat. Expect machinery to be installed by November. C. H. Doolittle and W. E. L. Dilloway interested.

CANADA

British Columbia

TONOPAH BELMONT DEVELOPMENT CO. (Bullitt Bldg., Philadelphia, Penn.)—Developments in Surf Inlet gold mine, on Princess Royal Island, proving satisfactory; subsidiary company, Surf Inlet Power Co., is building concrete dam of the Ambursen hollow type for a 2,000-hp. power development; a 7-in. transmission line will convey power to the mine; an electric-tram line to the head of navigation is proposed. Tonopah Belmont has given up its option on the Queen gold mine, near Salmo, B. C.; also on the Bull Moose low-grade gold mine at Beatty, Nev., and on the Copper Queen group in the Santa Fe copper-mining, Mineral County, Nevada.

Ontario

PERSEVERANCE (Porcupine)—This property, north of the Davidson, to be developed.

BOSTON CREEK MINES (Boston Creek)—Has opened rich oreshoot 40 ft. long and 2 ft. wide.

WEST DOME CONSOLIDATED (Porcupine)—New high-grade vein encountered on 300-ft. level, 5 ft. wide.

MILLER LAKE-O'BRIEN (Gowganda)—A vein, 14 in. wide, carrying native silver, found on 30-ft. level.

NEWRAY (Porcupine)—Another vein carrying 5 ft. of high-grade ore with visible gold, found on the surface.

PORCUPINE CROWN (Timmins)—Winze being sunk from 700-ft. level is 40 ft. below 800-ft. level and still in rich ore.

McKINLEY-DARRAGH (Cobalt)—Has engineer examining properties in Skead Township. Company pursuing energetic exploration policy.

CONIAGAS (Cobalt)—Has option on Platt Veteran lot adjoining the Schumacher, in Porcupine district. Diamond drilling will be started immediately.

DOME (Porcupine)—Second ball mill should bring tonnage up to 1,400 tons a day. Difficult, however, to maintain tonnage and extraction. Development on Dome Extension indicates that this property will be taken over, probably involving a new mill using continuous-decantation process. Drilling on the Dome below the 700-ft. level to the 850 shows continuous ore averaging about $12; porphyry carries good gold content here. New central shaft will be completed next month. On the Dome Extension, drill No. 8 has cut 37 ft. of ore, averaging $7.40 and Drill No. 6 encountered 17 ft. averaging $12.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—In July crushed 20,282 tons; estimated profit £1,449.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable estimate, August cleanup $131,735. Treated in July 25,210 tons; bullion recoveries were: Tabowie mill, $26,243; Taracol, $21,596; Maibong, $25,630; Taracol cyanide bullion, $50,745; Maibong tube-mill bullion, $4,806; total, $128,751. Final figures for June showed 200 stamps ran 29.05 days crushing 26,511 tons yielding $138,280; net profit, $65,427.

The Market Report

Metal Markets

NEW YORK—Sept. 6

The markets were generally dull during the last week, there being practically two holidays. There were but slight changes in prices. Since Labor Day there has been a revival of interest, especially in copper and lead.

Copper, Tin, Lead and Zinc

Copper—The business of the week, which was transacted in four days, was materially less than in the previous week, which in turn was less than in the week before. In the absence of demand there were some sellers at concessions, and thre were early signs of reactionary tendency. Since the holiday, however, an improvement in sentiment has been observable, inquiries being received from numerous quarters, besides which an inquiry for 5,000 tons for Russian account developed on Sept. 6.

In the domestic market the noteworthy features were requests made by several manufacturers for deferral of their September copper to later months, owing to manufacturing difficulties. One manufacturer offered a round lot of September copper for resale and is supposed to have found a buyer in the neighborhood of 28c., New York. In general, producers have no September copper to offer and manufacturers are covered, but now and then some manufacturer finds himself in need of a little and may obtain it from some reselling manufacturer. These are, however, but sporadic cases. The major business of last week was for November-December delivery, with a little done for October delivery.

The Russian inquiry came through the British Ministry of Munitions, which is buying for the Russian government and called for bids f.o.b. New York. It is the understanding that the business is to be closed on Sept. 8. The delivery wanted is "as soon as possible."

The negotiations between the producers and the Allied Governments for a large quantity of copper wanted in the first half of 1917 appear to be all off. Without any doubt the copper is wanted, but it is believed here that a different policy in securing it may be followed; that is, instead of making one stupendous contract, the copper may be purchased in smaller blocks from time to time at the market. This would be much better from the standpoint of the producers, inasmuch as it would tend to give the market a more enduring stability. The execution of the huge contract which was contemplated would probably have resulted in some market complications later.

An interesting feature of the domestic market is the increasing extent to which domestic manufacturers, especially brass makers and sheet rollers, are adjusting their business on a toll basis; that is, copper is purchased for the account of their customers and is converted into brass and sheet on toll. The demands upon the rolling mills are so great that toll charges are high, 10c. per lb. being the common figure, while the wire drawers are getting only 1c.

Copper Sheets are unchanged at 37.5c. per lb. for hot rolled and 38.5c. for cold rolled. Copper wire is 31½@32c. per lb. for large lots at mill.

Copper Exports from Atlantic ports in August are estimated at 32,200 gross tons, or about 2,800 tons less than in July.

Copper exports from Baltimore for the week included 1,786,622 lb. copper and 550,816 lb. brass to France; 599,250 lb. brass to Italy.

Visible Stocks of Copper in Europe on Aug. 31 are reported as follows: Great Britain, 4,839; France, 2,675; afloat from Chile, 850; afloat from Australia, 3,150; total, 11,514 gross tons, or 25,791,360 lb. This is an increase of 492 tons over the Aug. 15 report.

Tin—This market was fairly active on Thursday and Friday. On Saturday no business was reported. Since the holiday the market has been dull.

Tin deliveries at Atlantic ports in August were 4,335 gross tons. The stocks of tin in warehouses and landing on Aug. 31 were 4,750 tons.

Visible Stocks of Tin Sept. 1 are reported as follows, including tin afloat: London, 7,666; Banka and Billiton (Holland), 1,230; United States, excluding Pacific ports, 9,146; total, 18,042 gross tons, which is a decrease of 362 tons from Aug. 1, but an increase of 2,917 tons over Sept. 1 of last year.

Lead—Lead for September delivery is very scarce. Those producers who can supply it easily obtain premiums over the price of the A. S. & R. Co. The latter company fills the orders of its regular customers but has no surplus to offer. After the holiday there was an improvement in demand and a stiffening of price, 6.60c., St. Louis, being realized for a round lot on Wednesday afternoon. There were several foreign inquiries in the market, including one of 2,000 tons from the Rumanian government.

Spelter—This market was very dull. Sales of September-October metal were made at 8¼c. St. Louis.

Zinc Sheets are in steady demand and business is fair. Quotations are unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 6

Aluminum—Demand continues good. Contract deliveries are being slowly made. Outside of these there is not much stock available, and prices are rather firm at 60@62c. per lb. for No. 1 ingots, New York.

Antimony—This metal is dull and lethargic. The principal producers are asking 13½@14c., but buyers are able to get such supplies as they need at 12@12½c., which we quote as the market for the last week.

Quicksilver—The improvement continued until $80 was realized, but demand halted and the market fell back to $77 and became dull. San Francisco reports, by telegraph, $76, market unsettled.

Nickel—Demand is good both from domestic and export business. Prices are firm and unchanged at 45@50c. per lb. for ordinary forms, according to size of order. A premium of 5c. per lb. is charged for electrolytic nickel.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—SEPT. 6

Gold—More arrivals of gold from Canada are reported in New York, and some has also come in direct from England.

Gold Receipts at New York for the week were very heavy, $25,000,000 being turned into the Assay Office by importers. Part of this came from Ottawa, but most of it from Halifax, having been brought to that port presumably by a British cruiser. All of it was on London account.

Imports of gold through the port of San Francisco seven months ended July 31 were $9,451,285; exports $24,128,969; leaving $14,677,684 excess of exports.

The gold reserve of Japan which was 353,000,000 yen at the end of July, 1914, is now reported at 600,000,000 yen, of which 400,000,000 yen are held by the Bank of Japan, 170,000,000 yen being the property of the government. The amounts subject to draft are 120,000,000 yen in the United States and 280,000,000 yen in England.

Platinum—At the close of last week, $80 was asked, and this week two producers reported that price realized, while one reported inability to get it. We quote $78@80 per ounce.

Silver—The market continued steady with an improvement in prices due to British Mint purchases and small arrivals of spot silver. Bombay exchanges are low and India has not been a buyer. On the other hand while China exchange continues below parity. China has stopped sales. The London market is quoted steady with healthy undertone and closes at 32½d. bid.

Imports and exports of silver in Great Britain seven months ended July 31 in sterling ounces:

	1915	1916	Changes
Imports.....	53,995,003	52,399,403	D. 1,595,600
Exports.....	40,167,994	30,150,667	D.10,017,327
Net imports	13,827,009	22,248,736	I. 8,421,727

For the corresponding period in 1914 the imports were 55,640,985 oz.; exports 65,875,762 oz.; showing 10,234,777 oz. excess of exports. The statement is remarkable in two particulars, the closeness with which the imports for each similar period approximate, and the wideness with which the exports differ from each other.

Imports of silver through the port of San Francisco seven months ended July 31 were valued at $1,823,724; exports, $4,340,788; leaving $2,517,064 excess of exports.

Mexican dollars were quoted in New York Aug. 31 at 51⅞@55¾c.; Sept. 1 at 52½@55½c.; Sept. 2 at 52½@55½c.; Sept. 5 at 52⅝@55⅝c.; Sept. 6 at 52¼@55¼ cents.

SILVER AND STERLING EXCHANGE

Aug. Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Sept.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
31	4.7575	67½	32	4	.....	...	32⅛
1	4.7575	68⅛	32 7/16	5	4.7575	68	32⅛
2	4.7575	67½	32⅛	6	4.7575	68¼	32⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug. Sept.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	26⅛	38⅛	6.50	6.40	8.25
31	@27⅛	@39	@6.60	@6.50	@8.37½
	26⅛		6.50	6.40	8.12½
1	@27⅛	38⅛	@6.60	@6.50	@8.37½
	*26⅛		6.50	6.40	8.12½
2	@27⅛	*38⅛	@6.60	@6.50	@8.37½
4	.....	.....	.....	.....	.....
	26⅛		6.50	6.40	8.12½
5	@27⅛	39	@6.65	@6.50	@8.37½
	26⅛		6.50	6.40	8.12½
6	@27⅛	39	@6.70	@6.60	@8.37½

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Aug. Sept.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
31	109	106	130	170¾	171⅛	31⅛	52
1	110	107⅛	130	170¼	171	31⅛	49
2	.....	.....	.....	.....	.....	.....	.....
4	109⅛	107	130	170¼	171¼	31	49
5	109	106⅛	130	170⅜	171⅛	31	49
6	109	106⅛	130	171	172	30⅞	48⅛

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 2—Price quotations per 2,000 lb.: Blende, high $65.70; per ton 60% zinc, premium ore, no sales, medium grades, $60@50, low $45. Calamine, per ton 40% zinc, $35@25. Average selling price, all grades of zinc, $61.52 per ton. Lead, base price $70@65; per ton 80% metal content. High price $70. Average selling price, all grades of lead, $67.29 per ton.

Shipments of the week—Blende 6,051 tons, calamine 389 tons, lead 1,027 tons. Value, the week, $465,300. Year's value, to date, $26,219,570.

The low average base price of last month scheduled another reduction in the wage scale, and some mines closed down tonight to forestall a possible labor disturbance. Labor trouble at Henryetta, Oklahoma, is practically at an end, the Henryetta Spelter Co. now having four blocks in operation; the fifth, having been drawn, will need new retorts. These are to be installed as rapidly as possible.

The strike situation on the railroads was at such a stage that there was practically no zinc market, as buyers were taking only what ore their customers insisted on selling at a general $5 cut in price.

Platteville, Wis., Sept. 2—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $56 for premium ore down to $50 for medium grades. For material assaying 80% lead the base price per 2,000-lb. tons is $71. Shipments for the week were 2,553 tons of zinc ore, 97 tons of lead ore, and 956 tons of sulphur ore. For the year to date, the figures are, 81,575 tons of zinc ore, 2,884 tons of lead ore, and 19,313 tons of sulphur ore. Shipped during week to separating plants, 3,274 tons of zinc ore.

NEW CALEDONIA ORES

New Caledonia ore exports for the six months ended June 30 are reported by the "Bulletin du Commerce" of Noumea at 12,554 metric tons of nickel ore and 29,528 tons chrome ore. Metal exports were 1,060 tons nickel matte.

OTHER ORES

Manganese Ore from Brazil brings 60@65c. per unit for 50% ore at seaboard. Indian ore is about 60c. per unit.

Arrivals at Baltimore for the week included 1,000 tons manganese ore from India.

Pyrites—Imports of pyrites into the United States in June were 85,836 gross tons in 1915, and 101,874 in 1916; increase, 16,038 tons.

Imports of pyrites in Great Britain seven months ended July 31 were 521,348 gross tons in 1915, and 609,427 in 1916; increase, 88,079 tons.

Tungsten Ore—A fairly large business was reported at about $20, but toward the close of the week the demand appeared to have been satisfied, some sellers reporting inability to effect transactions. At the close we quote the market at $17@20 per unit.

Antimony Ore—No change.

EXPORTS AND IMPORTS

Imports of Metals, other than iron and steel, in Great Britain seven months ended July 31 in gross tons:

	1915	1916	Changes
Copper.....	134,394	83,449	D. 50,945
Tin.....	26,962	21,068	D. 5,894
Lead.....	158,643	93,844	D. 64,799
Zinc.....	56,737	27,163	D. 29,574

Copper imports include the metallic contents of ore, matte and precipitate.

Spanish Exports of Metals six months ended June 30 as reported by "Revista Minera" in metric tons:

	1915	1916	Changes
Iron and steel....	74,803	59,424	D. 15,379
Copper.....	8,776	7,899	D. 877
Copper precip....	5,983	5,836	D. 147
Zinc.....	2,115	2,725	I. 610
Lead.....	72,109	93,606	I. 21,497
Quicksilver.....	700	1,152	I. 452

Imports of iron and steel were 37,155 tons this year; of tinplates, 5,125 tons; of tin, 752 tons.

Iron Trade Review

NEW YORK—Sept. 6

While export business is still the dominant feature in the market, a considerable number of new domestic orders is reported.

The domestic business includes some heavy contracts for bars from agricultural implement makers, who have been holding back for lower prices but have now come in. Structural steel orders are on the increase, many small building contracts having been closed. The demand for plates and shapes for shipbuilding is very heavy and promises to increase. The new vessels authorized by Congress for the Navy will require a large quantity of steel. The railroads are in the market more than for some time past, for rails, plates and bridge work.

The mills for the most part are falling back on their orders and premiums for early deliveries are again talked about, especially on plates. Under these circumstances there is not likely to be any weakening in prices.

The pig-iron market is again active. Some large transactions and inquiries in basic are reported, and there is also a demand for foundry iron. Prices have been rather irregular, but are gradually hardening. Contracts made not only cover fourth quarter, but run well into next year.

PITTSBURGH—Sept. 5

Yesterday proved more of a holiday in iron and steel offices than many expected last week. It would have been a busy day for many men if the railroad strike had really occurred at 7 o'clock that morning, for it would have been necessary to keep a careful watch on all materials in order to determine how long works could be kept runing. As it is, the holiday was very generally observed, and with quite a feeling of relief.

It is understood that some slight congestions were caused by the embargoes that were placed last week by the railroads, but on the whole the amount of tonnage tied up was not considerable. The markets were not affected, except the scrap market, which practically disappeared.

The threat that there would a railroad strike did not affect the various branches of the iron and steel market to any extent, and likewise the fact that there is no strike will not have any influence.

The tinplate mills are saying that they do not care to take any business to run over January. It is probable, however, that prices for next year may be made before very long.

Pig Iron—There has been no material change from last week's report. W. P. Snyder & Co. state the average for August at Valley furnaces at $21 for bessemer and $18 for basic pig, both unchanged from July. We quote: Bessemer, $21@21.50; basic,, $18@18.25; foundry and malleable, $18.50; forge, $18, f.o.b. Valley furnaces, 95c. higher deliver Pittsburgh.

Steel—The market for unfinished steel remains practically nominal at about $45@50 per ton. Inquiries are of rather light proportions. Whether the condition is due to the requirements being light or to possible buyers realizing that there is scarcely any use in inquiring it is difficult to determine. This is to be observed, however, that deliveries on regular contracts are quite satisfactory, according to all accounts. Export inquiry for unfinished steel is lighter than it was, the possible buyers having canvassed the situation so thoroughly, without finding any considerable tonnage of steel for sale for this year, that they have about given up inquiring.

FERROALLOYS

Ferrosilicon—Quotations on 50% ferrosilicon continue at $86@88 at furnace. Bessemer ferrosilicon is from $30 for 9% up to $41 for 16%, all at furnace. Supplies are rather more free than they have been.

Spiegeleisen—Quotations are unchanged at $40@45 per ton for 20% at furnace. For high grade, 25 to 30%, $55@65 per ton at furnace is asked.

Ferromanganese—The market has continued quiet with only moderate demand. Contract is available at $175 per ton still. Prompt lots bring about the same, there being no special demand.

FOREIGN IRON

British Iron Ore Production in 1915 is stated as follows according to lately received figures: Mined under Coal Mines Act, 6,080,218; Metal Mines Act, 1,795,887; Quarries Act, 5,100,000; total, 12,976,105 gross tons. This compares with 14,867,582 tons in 1914, and 15,997,328 in 1913; the decrease from 1914 being 1,891,477 tons, while from 1913 it was 3,021,223 tons.

British Furances in Blast during the quarter ended June 30 were 293, being five more than during the previous quarter.

Exports and Imports of Iron and Steel and manufactures thereof in Great Britain seven months ended July 31, as valued by Board of Trade returns:

	Exports	Imports	Excess, E.
Iron and steel.....	£34,788,953	£6,824,591	£27,964,362
Hardware, etc.....	6,385,635	407,707	5,977,928
Machinery..	10,381,299	5,082,587	5,298,712
New ships..	458,954	.....	458,954
Total....	£52,014,841	£12,314,885	£39,699,956
Total, '15	39,347,837	11,243,074	28,104,763

The quantities of iron and steel exported were 1,825,296 gross tons in 1915, and 2,182,142 in 1916; imported, 715,327 in 1915 and 562,283 this year.

German Steel Production in May is reported by the German Iron and Steel Union at 1,412,137 metric tons, the largest since 1914. For the five months ended May 31 the total was: Converter steel, 3,171,212; openhearth, 2,754,394; direct castings, 388,826; crucible steel, 43,973; electric steel, 70,760; total, 6,429,065 metric tons. This compares with 5,040,103 tons for the corresponding period in 1915, showing an increase of 1,388,962 tons, or 27.6% this year.

Belgian Production—An American correspondent who has been in Belgium and has had some opportunities to study the situation there estimates that in the Liege district the iron and steel works are now employing about 6,500 men, against 15,000 in normal times. The zinc works have 6,000, against 10,400 in 1913. In lead and other works about 1,200 are at work, or about half the normal force.

IRON ORE

Some more wild charters are reported at $1 per ton for iron ore from the head of the Lakes to Lake Erie ports. The rate fixed at the beginning of this season was 50c. Already there is talk of an advance in iron prices for next season, and it is probable that rates will be fixed at an earlier date than usual. This year's prices are $4.45 for Old Range and $4.20 for Mesabi bessemer; $3.70 for Old Range and $3.55 for Mesabi nonbessemer ore. An advance of $1 per ton is talked about..

In the cases relating to iron ore rates from Lake Erie ports, which have been pending for some time, the Interstate Commerce Commission on Sept. 5 ruled that rates on shipments and division of districts in Pennsylvania, Ohio, Kentucky and West Virginia were unreasonable and illogical. The commission ordered a revision of the charges and also ordered the railroads to establish separate charges for storing one on the docks, for dock services and for switching and other services on private tracks.

COKE

Connellsville—The coke market has been very quiet this week. It is possible that many users have laid in stocks ahead in expectation of a railroad strike. This probable accumulation would affect the market and it is not unlikely that coke may be quite plentiful with the pressure for deliveries removed. Quotations are practically unchanged. Production was up to the usual mark.

United States Fuel Exports in June were as follows, in gross tons:

	1915	1916		Changes
Anthracite....	352,636	515,139	I.	162,503
Bituminous...	1,933,410	2,065,509	I.	132,099
Coke.....	68,628	89,835	I.	21,207
Bunker coal..	727,880	727,168	D.	712
Total.....	3,082,554	3,397,651	I.	315,097

The bunker coal or coal taken by ships in foreign trade is practically all bituminous. The chief exports of coal and coke are to Canada.

Chemicals

NEW YORK—Sept. 6

The general markets are steady and rather firm, with a very good demand. Heavy chemicals are generally selling well with few or no price changes.

Arsenic—The tone of the market is slightly firmer. Demand is good and stocks are generally small. Both spot and futures are quoted $6@6.25 per 100 lb., according to size of order.

Copper Sulphate—Demand continues fair and prices are a little firmer. Quotations are $8.25@10.25 per 100 lb., according to size and terms of order.

Nitrate of Soda—Reports from South America show production largely above 1915, but somewhat short of 1914 and 1913. For the fiscal year ended June 30, 1916, the total production was 57,715,614 quintals; exports, 55,285,814 quintals, of which 23,484,842 quintals went to the United States. Stocks here are large but demand is fair and prices are firm at $3 per 100 lb. for both spot and futures.

Sulphuric Acid—Prices are unchanged at 1c. per lb. for 60-deg. acid and 1½c. per lb. for 66-deg. acid. It is said that some shading has been done on large long-time contracts.

Exports and Imports—Imports of sulphur into the United States in June were 3,560 gross tons in 1915, and 1,530 tons in 1916. Imports of pyrites were 85,836 tons in 1915, and 101,874 tons in 1916. Exports of sulphur were 1,637 gross tons in 1915, and 7,374 tons this year.

Imports of arsenic in June were 142,225 lb. in 1915, and 299,494 lb. in 1916; increase, 157,269 lb. this year.

Exports of copper sulphate in June were 144,268 lb. in 1915, and 2,069,243 lb. in 1916; increase, 1,924,975 lb. this year.

Exports of sulphuric acid in June were 5,931,208 lb. in 1915, and 9,421,735 lb. in 1916; increase, 3,490,527 lb. this year.

Imports of nitrate of soda in June were 93,076 gross tons in 1915, and 133,098 in 1916; increase, 40,022 tons this year.

Assessments

Company	Delinq.	Sale	Amt.
Alta Silver, Nev.	Sept. 1	Sept. 25	$0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Beaver Mines, Utah	Sept. 30	Oct. 21	0.0025
Blue Star, Ida.	Sept. 25	Oct. 21	0.02
Cash Boy, Nev.	Sept. 1	Oct. 15	0.01
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Coal Creek, Ida.	Aug. 25	Sept. 26	0.005
Con. Virginia, Nev.	Sept. 29	Oct. 20	0.05
Crown Point, Utah	Sept. 16	Oct. 10	0.005
Eagle Mountain, Ida.	Oct. 2	Nov. 4	0.001
Exchequer, Nev	Sept. 5	Sept. 26	0.03
Emerald, Utah	Aug. 15	Sept. 9	0.00½
Fortuna, Utah	Aug. 25	Sept. 14	0.005
Friend, Ida.	Aug. 26	Sept. 16	0.002
Great Bend, Nev.	Aug. 15	Sept. 20	0.01
Great Western, Nev.	Sept. 26	Oct. 18	0.01
Hector, Ida.	Aug. 7	Sept. 15	0.005
Idaho-Nevada, Ida.	Sept. 14	Oct. 14	0.002
Jacket-C.Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0.003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
Old Veteran, Ida.	Sept. 9	Oct. 7	0.002
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Paloma, Utah	Aug. 21	Sept. 9	0.01
Phedora, Ida.	Aug. 29	Sept. 29	0.001
Rio Grande Grubstake, Nev.	Sept. 22	Oct. 31	0.002
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0.01
Santaquin Chief, Utah	Sept. 11	Sept. 21	0.0025
Santaquin King, Utah	Sept. 11	Sept. 21	0.0025
Sells, Utah	Sept. 21	Oct. 7	0.06
Silver Pick, Nev.	Sept. 25	Oct. 30	0.01
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15		0.05
Syndicate, Utah	Sept. 18	Oct. 14	0.0015
Tar Baby, Utah	Aug. 3	Sept. 4	0.01
Tyler, Ida.	Sept. 12	Oct. 12	0.0015
Umatilla, Nev	Sept. 18	Oct. 24	0.0025
Uvada, Nev.	Oct. 9	Oct. 26	0.02
West Toledo, Utah	Sept. 12	Oct. 3	0.01
Whale, Utah	Sept. 5	Sept. 25	0.05
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0.005
Wonderful, Ida.	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Sept. 5 Name of Comp.	Bid.
Alta	.05
Andes	.08
Best & Belcher	.05
Bullion	.01
Caledonia	.35
Challenge Con.	.03
Confidence	.15
Cons. Imperial	.01
Con. Virginia	.11
Gould & Curry	.02
Hale & Norcross	.05
Jacket-Cr. Pt.	.08
Mexican	.16
Occidental	.70
Ophir	.24
Overman	‡.04
Savage	.06
Seg Belcher	.02
Sierra Nevada	.29
Union Con.	.67
Utah Con.	.01
Belmont	4.25
Jim Butler	.85
MacNamara	.04
Midway	.17
Mont.-Tonopah	.24
North Star	.19
Rescue Eula	.20
West End Con.	.70
Atlanta	.09
Blue Bell	.01
Booth	.12
C.O.D. Con.	.02
Comb. Frac	.06
D'field B.B.	.02
D'field Daisy	.03
Jumbo Extension	.41
Round Mountain	.09
Sandstorm Kendall	.05
Silver Pick	.18
Central Eureka	.07
Argo	.10
Ariz. Central	.15
Big Jim	1.10
Lazy Boy	.12
Oatman No. Star	‡.10
Tom Reed	1.60
United Eastern	3.87½
United Western	.08

LONDON Aug. 21	£	s	d
Alaska-Mexican	1	6	3
Alaska Tre'dwell	5	15	0
Burma Corp.	3	4	0
Cam & Motor	0	11	6
Camp Bird	0	8	6
El Oro	0	9	0
Esperanza	0	11	6
Mexico Mines	3	10	0
Nechi, pfd.	0	13	0
Oroville	0	16	9
Santa Gert'dis	0	13	0
Tomboy	1	2	6

SALT LAKE Sept. 1 Name of Comp.	Bid.
Alta Con.	.27
Black Jack	.04½
Colorado Mining	.15
Crown Point	.03½
Daly-Judge	8.00
Emma Cop.	.59
Gold Chain	.18
Grand Central	.55
Iron Blossom	1.50
Lower Mammoth	.05
May Day	.09½
Opohongo	.01
Prince Con.	1.40
Seven Troughs	.02½
Silver King Coal'n	2.87½
Silver King Con.	3.45
Sioux Con.	.09½
Uncle Sam	.03½
Yankee	.10

COLO. SPRINGS Sept. 5	
Acacia	.03½
Doctor Jack Pot	.10½
Elkton Con.	.15½
El Paso	.64
Findlay	.03½
Gold Sovereign	.06
Golden Cycle	2.13
Granite	.73
Isabella	.19½
Jack Pot	.05½
Jerry Johnson	.04
Mary McKinney	.26
Portland	1.65
Vindicator	1.90

TORONTO Sept. 4	
Adanac	‡.75
Bailey	.07½
Chambers Feriand	.18
Coniagas	4.55
La Rose	.60
Peterson Lake	.22
Right of Way	.05½
Seneca Superior	.25
T. & Hudson Bay	55.00
Temiskaming	.60
Trethewey	‡.21
Wettlaufer-Lor	.12
Dome Exten.	.06
Dome Lake	.43½
Foley O'Brien	.55
Hollinger	6.95
Jupiter	.28½
McIntyre	1.39
Newray	.66
Porcu. Crown	.79
Preston E. D.	‡.03
Vipond	.40½
West Dome	.39

N. Y. EXCH. Sept. 5 Name of Comp.	Cig.
Alaska Gold M.	12½
Alaska Juneau	7½
Am.Sm.&Ref.,com	101⅜
Am. Sm. & Ref., pf.	112½
Am. Sm. Sec., pf. A	96
Am. Sm. Sec., pf. B	84
Am. Zinc	35½
Am. Zinc, pf.	73
Anaconda	86⅜
Batopilas Min.	‡1½
Bethlehem Steel	487
Bethlehem Steel, pf.	135
Butte & Superior	67⅞
Chile Cop.	20
Chino	54
Colo. Fuel & Iron	49½
Crucible Steel	78⅛
Dome Mines	24⅛
Federal M. & S.	16
Federal M. & S., pf.	35½
Great Nor., ore ctf.	38⅛
Greene Cananea	48
Homestake	130
Inspiration Con.	58⅜
International Nickel	42⅛
Kennecott	50⅛
Lackawanna Steel	78½
Miami Copper	35
Nat'l Lead, com.	65
National Lead, pf.	111
Nev. Consol.	21½
Ontario Min.	6⅛
Quicksilver	2⅛
Quicksilver, pf.	4½
Ray Con.	25
Republic I&S, com.	54⅛
Republic I&S, pf.	113⅛
Sloss-Sheffield	48
Tennessee Copper	25
Utah Copper	84½
U. S. Steel, com.	98⅜
U. S. Steel, pf.	118½
Va. Iron C. & C.	45

N. Y. CURB Sept. 5	
Beaver Con.	.41
Buffalo Mines	.60
Butte & N. Y.	1½
Butte C. & Z.	5½
Caledonia	.56
Can. Cop. Corpn.	1 9/16
Cashboy	.07
Cerro de Pasco	36
Con. Ariz. Sm.	1 7/16
Con. Coppermines	2½
Con. Nev.-Utah	.25
Crystal Cop.	.97
First Nat. Cop.	4
Florence	.70
Goldfield Con.	.77
Goldfield Merger	.08
Granite	.20
Hecla Min.	4 11/16
Howe Sound	5
Jerome Verde	1 3/16
Joplin Ore & Spel.	.54
Kerr Lake	4⅛
Magma	16½
Majestic	⅛
McKinley-Dar-Sa.	.60
Mother Lode	.37
Nevada Hills	.16
N. Y. & Hond.	15½
Nipissing Mines	7½
Oro	.03
Ray Hercules	3⅜
Rochester Mines	.57
St. Joseph Lead	16⅜
Standard S. L.	1⅛
Stewart	.25
Success	.34
Tonopah	5⅛
Tonopah Ex.	5⅜
Tribullion	4 1/16
United Zinc	4½
White Knob, pf.	1⅞
White Oaks	4⅛
Yukon Gold	2

BOSTON EXCH Sept. 5 Name of Comp.	Bid
Adventure	2⅛
Ahmeek	101
Algomah	1½
Alloues	68
Ariz. Com., ctfs.	9½
Bonanza	.25
Butte-Ballaklava	1 1/16
Calumet & Ariz.	72½
Calumet & Hecla	540
Centennial	18
Copper Range	61⅛
Daly West	2½
East Butte	16⅞
Franklin	7½
Granby	85½
Hancock	14
Helvetia	.40
Indiana	3½
Island Cr'k, com.	43
Island Cr'k, pfd.	88½
Isle Royale	28
Keweenaw	5
Lake	12⅛
La Salle	4
Mason Valley	‡2½
Mass	13
Mayflower	3⅛
Michigan	3⅛
Mohawk	90⅛
New Arcadian	6½
New Idria	13
North Butte	21⅛
North Lake	1⅛
Ojibway	1½
Old Colony	1⅞
Old Dominion	69⅛
Osceola	88½
Quincy	85
St. Mary's M. L.	74½
Santa Fe	1½
Shannon	8⅛
Shattuck-Ariz.	28⅛
So. Lake	6½
So. Utah	.20
Superior	15½
Superior & Bost.	3⅛
Tamarack	37½
Trinity	5⅛
Tuolumne	.40
U. S. Smelting	72⅛
U. S. Smelt'g, pf.	51
Utah Apex	3 1/16
Utah Con.	14½
Utah Metal	7⅛
Victoria	3½
Winona	5
Wolverine	54½
Wyandot	1½

BOSTON CURB Sept. 5	
Bingham Mines	9½
Boston Ely	.94
Boston & Mont.	.76
Butte & Lon'n Dev.	.59
Calaveras	5⅛
Calumet-Corbin	.02
Chief Con.	1⅞
Cortez	.34
Crown Reserve	.47
Davis-Daly	2 1/16
Eagle & Blue Bell	1⅛
Houghton Copper	1½
Iron Cap Cop., pf.	5½
Mexican Metals	.36
Mines of America	2½
Mojave Tungsten	3½
Nat. Zinc & Lead	1 1/16
Nevada-Douglas	1½
New Baltic	2
New Cornelia	14⅛
Ohio Copper	.C7
Oneco	.80
Raven Copper	.07
Rex Cons.	.20
Rilia	.17
United Verde Ext.	37

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	1915	1916	London 1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	1916	London Standard 1915	1916	London Electrolytic 1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York 1915	1916	London 1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York 1915	1916	St. Louis 1915	1916	London 1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York 1915	1916	St. Louis 1915	1916	London 1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11 582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	1916	Basic‡ 1915	1916	No. 2 Foundry 1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17 57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.